FILE COPY

2777

WATER PLANT OPTIMIZATION STUDY BURLINGTON WATER TREATMENT PLANT

JANUARY 1994

Ontario

Ministry of
Environment
and Energy

ISBN 0-7729-3292-1

WATER PLANT OPTIMIZATION STUDY

BURLINGTON WATER TREATMENT PLANT

JANUARY 1994

Cette publication technique
n'est disponible qu'en anglais.

Copyright: Queen's Printer for Ontario, 1994
This publication may be reproduced for non-commercial purposes
with appropriate attribution.

PIBS 2777

Study Conducted By:

Simcoe Engineering Group Limited

Under the Direction of the
Burlington Project Committee:

Ann Vajdic - MOEE Water Resources Branch
Vince Suffoletta - Regional Municipality of Halton
Grant Yarrow - MOEE Oakville District Office
Bill Gregson - MOEE Project Engineering Branch
Janusz Budziakowski - MOEE Approvals Branch
Gerry Sigal - R.V. Anderson Associates Ltd.

Address all correspondence to:

Ministry of Environment and Energy
Water Resources Branch
40 St. Clair Ave. West, 14th Floor
Toronto, Ontario
M4V-1M2

Please note that some of the recommendations contained in this report may have already been completed at time of publication. For more information, please contact the local municipality, or the Water Resources Branch of the Ministry of Environment and Energy.

Note, all references to Ministry of the Environment in this report should read Ministry of Environment and Energy.

WATER PLANT OPTIMIZATION STUDY

BURLINGTON WATER PURIFICATION PLANT

Summary of Findings and Recommendations

This Water Plant Optimization Study (WPOS) was initiated by the Ministry of the Environment (M.O.E.) to review the operating conditions over a 3-year study period and determine an optimum treatment strategy for contaminant removal at the Burlington Water Purification Plant. This optimization study is part of the on-going Drinking Water Surveillance Program (DWSP) which has been implemented to provide a continuously updated database on Ontario drinking water quality.

The Burlington Water Purification Plant is generally well run and plant performance in terms of both turbidity removal and disinfection has been excellent.

The following recommendations are made in an effort to optimize plant performance:

Studies

- Conduct a Filter Media Study to determine media intermixing and efficiencies of the backwash process. (This recommendation has already been implemented.)
- Conduct bench-scale and plantscale studies to assess the use of poly-aluminum chloride as a primary coagulant.
- Review the effectiveness of the existing coagulant aid including the location of the polymer injection point as well as the mixing efficiency of the polymer and alum.
- Conduct a plant flow audit to ensure that the measuring components are performing within accurate ranges.
- Evaluate the use of powdered activated carbon and/or granular activated carbon for taste and odour control.

- Review the existing wastewater system to ensure there are not unnecessary overflows to the lake.
- Investigate the plant hydraulics.
- Review the chlorination system to determine if there is any need to increase post-chlorination time.

Plant Modifications

- Install a streaming current monitor to assist in determining optimum coagulant dosages.
- Replace mercury float switches at various locations throughout the plant.
- Review and upgrade laboratory equipment.
- Install in-line continuous turbidity monitoring systems for each filter.

Other

- Monitor the integrety of the P.V.C. liners in the wood stave hydrofluosilicic acid and aluminum sulphate storage tanks on a regular basis.
- An emergency contingency plan should be developed for the Burlington Water Purification Plant. This plan should address emergency situations in the plant including chemical spills. As part of this plan, a software package should be prepared to allow for simulation of situations as part of the operator training.

TABLE OF CONTENTS

TABLE OF CONTENTS

SUMMARY OF FINDINGS AND RECOMMENDATIONS

TABLE OF CONTENTS

INTRODUCTION

TERMS OF REFERENCE I-1
INTRODUCTION I-1
PLANT BACKGROUND I-1
OPERATION OVERVIEW I-2

SECTION A - RAW WATER SOURCE

A.1 GENERAL A-1
A.2 PHYSICAL WATER QUALITY A-1
A.2.1 Colour A-2
A.2.2 Temperature A-2
A.2.3 Taste and Odour A-3
A.2.4 Turbidity A-3
A.3 CHEMICAL WATER QUALITY A-4
A.3.1 pH A-4
A.3.2 Inorganic Parameters A-4
A.3.3 Organic Parameters A-4
A.3.4 Alkalinity A-5
A.3.5 Hardness A-5
A.4 MICROBIOLOGICAL WATER QUALITY A-5
A.5 RADIOLOGICAL WATER QUALITY A-6

SECTION B - FLOW MEASUREMENT

B.1 GENERAL B-1
B.2 RAW WATER FLOW MEASUREMENT B-1
B.3 FILTERED WATER FLOW MEASUREMENTS B-1
B.4 BACKWASH WATER FLOW MEASUREMENT B-1
B.5 TREATED WATER FLOW MEASUREMENT B-2
B.6 VALIDITY OF RECORDS B-2
B.7 CONCLUSIONS B-3

SECTION C - PROCESS COMPONENTS

C.1 GENERAL C-1
C.2 DESIGN DATA C-1
C.2.1 Capacity C-1

C.3 PROCESS COMPONENT INVENTORY C-2
C.3.1 Intakes C-2
C.3.2. Screens C-2
C.3.3 Low Lift Pumps C-3
C.3.4. Flash Mixing C-4
C.3.5 Flocculation C-5
C.3.6 Sedimentation C-6
C.3.7. Filters C-6
C.3.8 High Lift Pumps C-10
C.3.9 Backwash Treatment & Sludge Disposal C-11
C.4 CHEMICAL SYSTEMS C-13
C.4.1 Chlorine C-13
C.4.2. Aluminum Sulphate C-15
C.4.3 Polymer C-16
C.4.4 Fluoride C-17
C.5 SAMPLING C-17
C.6 PROCESS AUTOMATION C-18
C.7 STANDBY POWER C-18

SECTION D - PLANT OPERATION

D.1 GENERAL DESCRIPTION D-1
D.1.1 General D-1
D.1.2 Operation D-1
D.2 FLOW CONTROL D-1
D.2.1 Low lift Pumps D-1
D.2.2 Flocculation D-2
D.2.3 Filtration D-3
D.2.4. High lift Pumps D-3
D.3 DISINFECTION PRACTICES D-4
D.3.1 Pre-chlorination D-4
D.3.2 Post-Chlorination D-4
D.4 OPERATION OF SPECIFIC COMPONENTS D-5
D.4.1 Intakes D-5
D.4.2 Screening D-5
D.4.3 Low Lift Pumping D-6
D.4.4 Flash Mixing and Flocculation D-6
D.4.5 Filters D-6
D.4.6 Clearwells and Suction Wells D-8
D.4.7 High Lift Pumping D-9

D.5 CHEMICALS D-10
D.5.1 Pre-Chlorination D-10
D.5.2 Particulate Removal D-10
D.5.3 Post Chlorination D-11
D.5.4 Fluoridation D-11

D.6 SAMPLING AND DATA COLLECTION D-12
D.7 PROCESS AUTOMATION D-13
D.8 DAILY OPERATOR DUTIES D-13

SECTION E - PLANT PERFORMANCE (PARTICULATE REMOVAL)

E.1 TURBIDITY REMOVAL E-1
E.1.1 General E-1
E.2 PLANT PERFORMANCE (TURBIDITY) E-1
E.3 TREATABILITY TESTING E-4
E.4 OPTIMUM REMOVAL STRATEGIES E-4
E.5 PERFORMANCE (COLOUR) E-5
E.6 CONCLUSIONS E-5

SECTION F - PLANT PERFORMANCE (DISINFECTION)

F.1 GENERAL F-1
F.2 LEVEL OF DISINFECTION F-1
F.3 OPTIMUM REMOVAL STRATEGIES F-3
F.4 CONCLUSIONS F-3

SECTION G - IMMEDIATE AND SHORT TERM MODERATIONS

G.1 GENERAL G-1
G.2 IMMEDIATE MODIFICATIONS G-1
G.2.1 Filter Media Study G-1
G.2.2 Backwash Evaluation G-1
G.2.3 Coagulant Study G-2
G.2.4 Polymer Study G-2
G.2.5 Plant Flow Audit G-2
G.2.6 Streaming Current Monitor G-2
G.3 SHORT TERM MODIFICATIONS G-2
G.3.1 Chemical Tanks G-2
G.3.2 Replacement of Mercury Switches G-3
G.3.3 Laboratory Equipment G-3
G.3.4 Upgrading of Filter Effluent Turbidity Monitoring G-3
G.3.5 Taste and Odour Control Study G-3
G.3.6 Study of Waste Water System G-3

SECTION H - LONG TERM MODIFICATIONS

H.1 GENERAL H-1
H.2 LONG TERM MODIFICATIONS H-1
H.2.1 Investigation of Plant Hydraulics H-1
H.2.2 Installation of Additional Flocculation Tanks and Filters H-1
H.2.3 Post Chlorination Contact Time H-2
H.2.4 Emergency Contingency Plan H-2

TABLES

A1 Burlington Water Purification Plant Colour Levels Summary 1984-1986 . . . . . A-2
A2 Burlington Water Purification Plant Summary of Bacteriological Testing (1986) Total Coliform A-5
A3 Burlington Water Purification Plant Summary of Bacteriological Testing (1986) Fecal Coliform A-6
B1 Burlington Water Purification Plant Flow Metering Equipment B-1a
C1 Burlington Water Purification Plant Summary of Low Lift Pumping Units C-4
C2 Burlington Water Purification Plant Flocculation Detention Time and G Values C-6
C3 Burlington Water Purification Plant Filter Rates C-8
C4 Burlington Water Purification Plant Filter Data C-8a
C5 Burlington Water Purification Plant High Lift Pumps C-10
C6 Burlington Water Purification Plant Sampling Systems C-18
D1 Burlington Water Purification Plant Clearwell Capacity Versus Pumping Rate D-9
D2 Burlington Water Purification Plant Fluoride Level Summary D-12
D3 Burlington Water Purification Plant In-Plant Monitoring D-12a
E1 Burlington Water Purification Plant Particulate Removal Profile E-2
E2 Burlington Water Purification Plant Average Turbidity Raw and Treated Water E-3a
E3 Burlington Water Purification Plant Colour Level Summary E-5
F1 Burlington Water Purification Plant Disinfection F-2

DRAWINGS

1 Burlington Water System .... (opposite) I-1
2 Water Plant Layout C-18b
3 Burlington Water Purification Plant Schematic Flow Diagram C-18c
4 Burlington Water Purification Plant Optimization Study C-18d
4 Burlington Water Purification Plant Optimization Study .... (also Fold out at rear)
5 Intakes C-18e
6 Burlington Water Purification Plant Raw Water and Low Lift Diagram C-18f
7 Burlington Water Purification Plant Chlorine Schematic C-18g
8 Burlington Water Purification Plant Aluminum Sulphate Flow Diagram C-18h
9 Burlington Water Purification Plant Hydrofluosilicic Acid Flow Diagram C-18i
10 Burlington Water Purification Plant Clearwell Storage & Flow C-18j
11 High Lift Pumping Station Schematic C-18k

APPENDICES

Table 1.0 Raw and Treated Water Flows (ML/d) 1984,1985,1986 .... APP-1
Table 1.1 Treated Water Daily Flows (ML/d) 1984, 1985, 1986 .... APP-2
Table 2.0 Particulate Removal Summary 1984-1986 .... APP-8
Table 2.1 Particulate Removal Profile (January, May, July, October)/1984 .... APP-12
Table 2.1 Particulate Removal Profile (January, May, July, October)/1985 .... APP-20
Table 2.1 Particulate Removal Profile (January, May, July, October)/1986 .... APP-28
Table 3.0 Disinfection Summary 1985, 1986 .... APP-36
Table 3.1 Disinfection Summary 1984 .... APP-40
Table 3.2 Disinfection Profile (January, May, July, October)/1984 .... APP-44
Table 3.2 Disinfection Profile (January, May, July, October)/1985 .... APP-52
Table 3.2 Disinfection Profile (January, May, July, October)/1986 .... APP-60
Table 4.0 T & O Control, Alkalinity ADJ. & Fluoridation Summary 1984-1986 .... APP-68
Table 4.1 T & O Control, Alkalinity ADJ. & Fluordation Profile (January, May, July, October)/1984 .... APP-70
Table 4.1 T & O Control, Alkalinity ADJ. & Fluoridation Profile (January, May, July, October)/1985 .... APP-78
Table 4.1 T & O Control, Alkalinity ADJ. & Fluoridation Profile (January, May, July, October)/1986 .... APP-86

Table 5.0 Water Quality 1-Year Summary 1986 .... APP-94
Table 5.1 Water Quality 1-Year Summary 1985 .... APP-112
Table 5.2 Water Quality 1-Year Summary 1984 .... APP-130
Table 5.3 Water Quality 3-Year Summary 1984-1986 .... APP-148
Table 6.0 Bacterioligical Testing 1984, 1985, 1986 .... APP-167

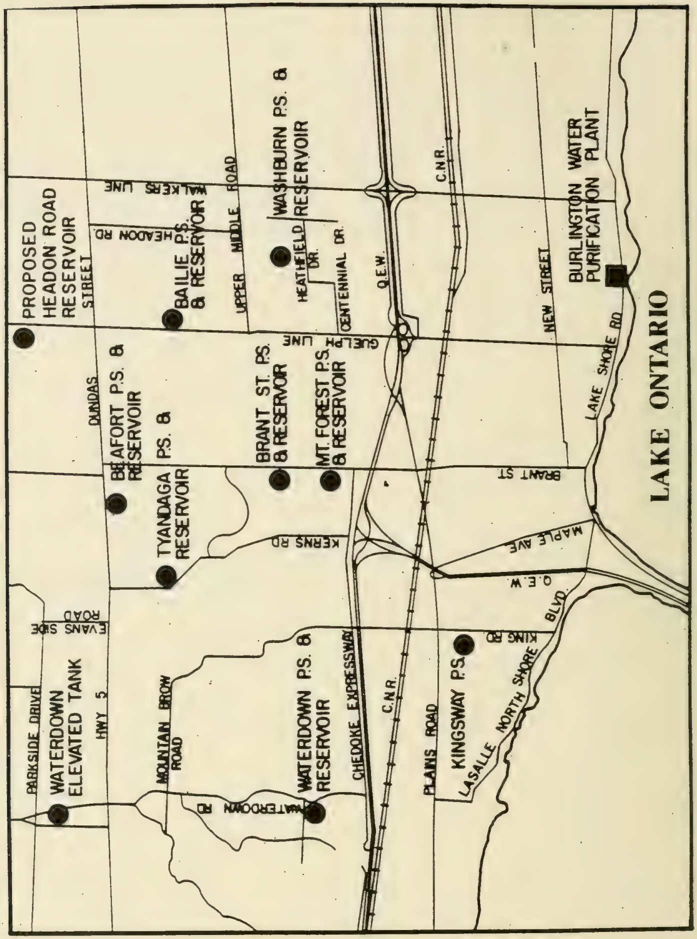
SAMPLE DAILY LOG SHEETS APP-170

SAMPLE WATER COMPLAINT SHEETS APP-173

PLANT INSPECTION SUMMARY APP-174

PHOTOGRAPHIC RECORD OF PLANT FACILITIES APP-179

INTRODUCTION



Drawn By	BURLINGTON WATER SYSTEM
Date	
Scale	
Date	Dwg No 1

ONTARIO MINISTRY OF THE ENVIRONMENT

BURLINGTON WATER PURIFICATION PLANT OPTIMIZATION STUDY

M.O.E. PROJECT NO. 7-2017

TERMS OF REFERENCE

The Drinking Water Surveillance Program (DWSP) of the Ontario Ministry of the Environment (M.O.E.) consists of a continuously updated base of information on Ontario water treatment plants and water quality. For each plant entering the program, a specific plant investigation and process evaluation study is required. The purpose of this study, the Water Plant Optimization Study (WPOS), is to document and review the existing operating conditions and to determine an optimum treatment strategy for contaminant removal at the plant. The Ministry of the Environment has prepared a detailed Protocol for the Water Plant Optimization Study which has been distributed to the Consultants engaged for the studies. This particular study for the Burlington Water Purification Plant has been conducted in accordance with the Protocol.

INTRODUCTION

The Burlington Water Purification Plant (W.P.P.) is located on Lakeshore Road approximately one kilometre west of Walkers Line at the Lake Ontario shoreline in the City of Burlington, as indicated on Drawing No. 1. The service area extends as far north as Highway #5 between Burloak Drive and Waterdown Road. A small portion of south west Oakville, west of Bronte Creek is also serviced by the Burlington Water Distribution System.

The Burlington W.P.P. High Lift Station supplies water directly to the service area near the lake (pressure Zone #1), as well as providing water to the Kingsway, Brant Street, Washburn and Mount Forest Pumping Stations for re-pumping to successive pressure zones at higher elevations.

PLANT BACKGROUND

The Burlington Filtration Plant was originally constructed in 1935. The first major plant expansion was undertaken in 1950. Two filters and settling basins were added to increase filtration capacity. In 1954 another intake and a new raw water low lift pumping station was constructed. In 1956 two additional filters and settling basins were constructed. Another major expansion took place in 1960 including two filters, settling basins, new low lift pumping station and modifications to the high lift station. A new intake was constructed in 1963. In 1970 two new filters were constructed to meet maximum day conditions, along with the addition of low lift and high lift pumps. In 1977 the Burlington Water Purification Plant underwent a six year program of expansions and renovations that were completed in 1983. The major expansions included:

1. A computerized supervisory and control system
2. A new high lift pumping station
3. Additional filtration capacity (four filters)
4. A new chemical building
5. Additional raw water pumping capacity
6. A new administration/control building

OPERATION OVERVIEW

The Burlington Water Purification Plant receives its raw water supply from Lake Ontario and treats it through a direct filtration process. The major process units are as follows:

a) Intakes, Screens and Low Lift Pumping
b) Flocculation
c) Filtration
d) Clearwell Storage
e) High Lift Pumping

Each of these major process units is described in Section C of this report.

SECTION A

RAW WATER SOURCE

SECTION A

RAW WATER SOURCE

A.1 GENERAL

The source of the raw water for the Burlington Water Purification Plant is Lake Ontario. There are two intakes through which the raw water flows by gravity. At present, treatment provided for the raw water includes screening, flocculation and filtration with chemical treatment consisting of chlorine disinfection, aluminium sulphate and polymer for coagulation, and fluoridation. The Regional laboratory analyzes for general chemistry, metals (iron only), purgeables, organochlorides, and bacteria. Chemical samples at the Burlington Water Purification Plant are analyzed monthly by the M.O.E. under the DWSP program.

In the years 1984 to 1986, the general raw water quality parameters varied as follows:

Turbidity (FTU)	0.48 - 62.0
Colour (TCU)	<0.5 - 8.0
Temperature (°C)	2 - 24
Alkalinity (mg/L as $CaC0_3$)	93.3 - 103.3
Hardness (mg/L as $CaC0_3$)	125.5 - 138.7
pH	7.7 - 8.4
Ammonia (mg/L)	0.00 - 0.36

The quality of the water has been categorized as physical, microbiological, radiological and chemical in the following sections. The source and methods used for determining quality, validity of data and seasonal trends have been noted where applicable.

A.2 PHYSICAL WATER QUALITY

The physical water quality characteristics, other than turbidity, do not directly affect the safety of supply; however, they may cause aesthetically objectionable effects. The physical qualities such as colour, clarity, taste, odour and temperature effect the acceptability of drinking water to consumers.

A.2.1 Colour

Tables 5.0 to 5.2 in the Appendix list the colour levels measured in the raw and treated waters by the Ontario Ministry of the Environment laboratories. The results of the three year period from 1984 - 1986 are also summarized in Table A1.

TABLE A1

BURLINGTON WATER PURIFICATION PLANT
COLOUR LEVELS SUMMARY
1984-1986

	1984 RAW	1985 RAW	1986 RAW
* Maximum	8.0	4.75	6.0
* Minimum	3.0	2.0	<0.5
* Average	5.5	2.94	2.9

* *All units in TCU*

The raw water sample results indicate that the average colour level is 5.5 TUC (True Colour Units). The raw water colour varied from <0.5 to 8.0 TCU during the period of 1984-1986. The treated water sample results indicate that the colour levels are well below 5 TCU over the same period. According to the Ministry of the Environment, Ontario Drinking Water Objectives, colour becomes noticeable to consumers at levels greater than 5 TCU. There seems to be no seasonal trend with respect to colour, according to the data presented herein.

A.2.2 Temperature

The temperature of the raw water at the Burlington Water Purification Plant ranges between 2°C recorded in February/March 1986 and 24°C in August 1984. There are no set limits for the temperature of drinking water but the palatability is enhanced by its coolness. It is desirable that the temperature of drinking water be less than 15°C.

A.2.3 Taste and Odour

The Burlington Water Purification Plant presently does not treat for taste and odour problems. Provisions are available to use chlorine dioxide for taste and odour control but this has not been necessary. There have been very few taste or odour occurrences recorded over the three year study period. Chlorine dioxide was used until December 12, 1985 after which its use was discontinued. It was found that there was a metallic taste imparted to the water by the chlorine dioxide.

A.2.4 Turbidity

Turbidity is the general term given to silt, sediment, algae, and other particulates in water that may shield microorganisms from a disinfectant.

The Ministry of the Environment Ontario Drinking Water Objectives require that the turbidity of finished water leaving a water plant not exceed one turbidity unit (1 Formazin turbidity unit - FTU or 1 nephelometric turbidity unit - NTU) for health considerations. The turbidity of the raw and treated waters measured at the plant is tabulated and summarized in Tables 2.0 and 2.1 in the Appendix. The levels measured at the MOE laboratories are summarized in Tables 5.0 to 5.2.

The raw water turbidity at the Burlington Plant varies seasonably and is higher in spring possibly due to runoff and greater rainfall. The two intakes extend 500 m and 734 m into Lake Ontario, with intake cribs submerged approximately 9.0 m at low lake levels, and are not normally affected by everyday lake turbulence. Over the three year study, the turbidity varied from a low of 0.48 FTU to a high of 62.0 FTU. Typically the raw water turbidity is less than 4 FTU.

Plant and laboratory turbidity measured values do not always coincide, but the variations are minor (probably due to variations in calibration) and the observed values are consistent. Effluent turbidity was below 1.0 FTU (often well below) on all but two days during the study period.

A.3 CHEMICAL WATER QUALITY

A.3.1 pH

The pH of raw and treated water is measured on-site by the Region of Halton's plant operation staff. The pH is measured three times daily and is determined colourimetrically using a spectrophotometer. The pH of raw water is also monitored and recorded continuously by the computer. The raw water pH varied between 7.7 to 8.4 over the three year period 1984-1986. The results indicate that the pH of the raw and treated water is well within the Ontario Drinking Water Objectives range of 6.5 and 8.5 and does not fluctuate significantly.

The pH is also measured by the MOE and the results correspond closely with the plant and laboratory measurements. The MOE laboratory results are summarized in Tables 5.0 to 5.2 while the plant results are summarized in Tables 2.0 and 2.1. There are no seasonal trends in pH evident from either of the sets of data, and raw water pH levels have remained relatively constant over the three year study period.

A.3.2 Inorganic Parameters

The only raw water inorganic chemical parameter measured at the plant is pH as described above. The inorganic chemical parameters relating to health and aesthetics that are measured by the Regional laboratory include iron, hardness, magnesium, sodium, alkalinity, chloride, sulphate, nitrate and nitrite. The results of raw and treated water analyses are contained in Tables 5.0 to 5.2. During the three year study period, the raw and treated water was consistently below the desired limits of these parameters.

A.3.3 Organic Parameters

The raw water organic chemical parameters that are measured at the Regional laboratory include the total Kjeldahl nitrogen and dissolved organic carbon concentrations, both of which are aesthetic parameters. The health related raw water organic chemical parameters that are measured include various trihalomethanes, PCB's, organochlorides and pesticides. There were no organic parameters above the desired limits in both raw and treated water.

A.3.4 Alkalinity

The raw water alkalinity is stable and did not vary more than 11% over the study period. Raw water alkalinity varies from 93.3 to 103.3 mg/L as $CaCO_3$ which is typical for Lake Ontario.

A.3.5 Hardness

The raw water hardness is also quite stable and did not vary more than 10% over the three year period from 1984-1986. Raw water hardness varied from 125.5 to 138.7 mg/L as $CaCO_3$ which is typical for Lake Ontario.

A.4 MICROBIOLOGICAL WATER QUALITY

There are no facilities available at the plant to conduct particle or algae counts. Since March 1986, bacterial counts and general chemical analyses have been performed on a weekly basis by the Regional Health Department located in Oakville. Previously these analyses were performed by the M.O.E. Laboratory. Tables 5.0 to 5.2 and 6.0 in the Appendix are monthly summaries of bacteriological testing for raw (and treated) water for 1984 - 1986. During 1986, there were 84 samples taken (42 raw and 42 treated) and the results of the raw water samples are summarized in Tables A2 and A3, as follows:

TABLE A2

BURLINGTON WATER PURIFICATION PLANT
SUMMARY OF BACTERIOLOGICAL TESTING (1986)
TOTAL COLIFORM

MPN	RAW
Absent	0
1 - 100	38
101 - 5000	4
>5000	0
Total Number of Samples	42

TABLE A3

BURLINGTON WATER PURIFICATION PLANT
SUMMARY OF BACTERIOLOGICAL TESTING (1986)
FECAL COLIFORM

MPN	RAW
Absent	0
1 - 100	39
101 - 5000	3
>5000	0
Total Number of Samples	42

Throughout the three year study period from 1984-1986, the monthly raw water samples showed fecal coliform counts ranging from 1 per 100mL to 116 per 100mL sample.

A.5 RADIOLOGICAL WATER QUALITY

Radiological analysis is not performed on the raw or treated water at the Burlington Water Purification Plant.

SECTION B

FLOW MEASUREMENT

SECTION B

FLOW MEASUREMENT

B.1 GENERAL

Based on the information supplied to us by the Regional Municipality of Halton staff, we have prepared Tables 1.0 and 1.1 in the Appendix for raw and treated water flows for the period 1984-1986. Table B1 summarizes the flow metering equipment at the Burlington Water Purification Plant.

B.2 RAW WATER FLOW MEASUREMENT

The two raw water venturi flow meters with Rosemount differential pressure transmitters in the low lift station measure the rate of flow entering the flocculation tanks.

Raw water rate of flow indication, recording and totalizing is performed continuously and is summarized every eight hours (3 times per day) by the plant operators, and on a continuous basis by the process computer.

B.3 FILTERED WATER FLOW MEASUREMENTS

Filtered water flow is measured by BIF and Gould differential flow units. There are a total of eight flow meters, one unit per filter. The flow is then totalized by the process computer.

B.4 BACKWASH WATER FLOW MEASUREMENT

The backwash pumps take filtered water from the clearwell and pump it upwards through the filter. The amount of water used during backwash varies, but is generally about 4% of the filtered water.

The BIF flow meter signals are totalized to determine the amount of water used in the backwash process and this is recorded after every backwash. It is recorded on a continuous basis by the computer.

TABLE B1

BURLINGTON WATER PURIFICATION PLANT
FLOW METERING EQUIPMENT

SERVICE	NUMBER	PRIMARY DEVICES	LINE SIZE	FLOW ML/d	RANGE	TRANSMITTER	LOCATION	INSTRUMENTATION
1. Raw Water	2	Short form Venturi	900 mm 900 mm	172 86.4	8:1 8:1	Rosemount	Lower pipe gallery one on north header one on south header	Flow recorded and totalized to RTU then central control
2. Filter Effluent	8	BIF style 623 Venturi	Filter nos. 8,9,10,11, 12,13,14,16	26 34.6	5:1 5:1	6 BIF Model 251-11 2 Gould	Upper pipe gallery for each filter effluent valve to clearwell	**Flow recorded and totalized to RTU then central control**
3. Filter Backwash	2	Short form Venturi	900 mm 900 mm	130 130	8:1 8:1	BIF Model 251-11	New pipe gallery on backwash header to waste holding tank	Flow recorded and totalized to RTU then central control
4. Treated Water	2	Short form Venturi	1050 mm 1050 mm	259 259	8:1 8:1	BiF Model 251-11	High lift pumps - one on discharge header for pumps 1, 2 and 3 on discharge header for pumps 4, 5, and 6	Flow recorded and totalized to RTU then central control
5. Waste Water	1	Magnetic Flowmeter	250 mm	16	8:1	Krohne	Discharge line from waste holding tank for #9 sewage pumping station	Flow recorded and totalized to RTU then central control

B.5 TREATED WATER FLOW MEASUREMENT

There are two short form venturi tubes, one on each 1050mm diameter discharge header leaving the high lift station. Each flow meter is independent and the individual flows are totalized on a continuous basis by the process computer.

In the City of Burlington the average day per capita production for the three years is as follows:

1986 average day per capita production = 501 Lpcd (110 gpcd)
1985 average day per capita production = 478 Lpcd (105 gpcd)
1984 average day per capita production = 493 Lpcd (108 gpcd)

B.6 VALIDITY OF RECORDS

The monthly summary for raw and treated waters in Table 1.1 is a good indication of seasonal trends in water consumption. It is evident that the City of Burlington water consumption follows the general trend of higher consumption during the summer months.

The plant data written on the daily log sheets show few discrepancies in raw, treated and backwash flows.

The validity of the methods of flow measurement is limited to the accuracy of the flow meters used at the plant. The flow meters are calibrated when the flow readings are considered to be abnormal by plant operations staff. The preventative maintenance program takes care of calibration normally on an annual basis. Calibration consists of re-setting the zero and span adjustments on the differential pressure transmitters.

Studies have been conducted to examine the accuracy of the flow meters throughout the plant. It has been concluded that the range on the treated water flow meters has resulted in significant errors at the lower end of the measuring range where the venturi tubes normally operate. The Regional Municipality of Halton will be commissioning a study to examine ways of improving the lower end accuracy of the treated water (high lift pumping station) flow metering equipment. A complete plant flow audit might ensure that the measuring components are performing within accurate ranges.

The plant data and other typical per capita flows for the local region are similar. The following are typical average day per capita flow rates for the Regional Municipality of Halton:

Oakville	469 Lpcd (103 gpcd)
Milton	450 Lpcd (99 gpcd)
Acton	396 Lpcd (87 gpcd)
Georgetown	517 Lpcd (114 gpcd)
Total (Including Burlington)	**441 Lpcd (97 gpcd)**

It is apparent that the average day per capita flow rates in Burlington are higher than the average for the Regional Municipality of Halton. It has been documented in other reports that the industrial contribution to consumption in Burlington is significantly higher than in other Municipalities. This would explain the higher level of per capita production recorded. Reference is made to the City of Burlington Water Distribution Update Study prepared by Simcoe Engineering Group Limited dated September 1983, for further information.

B.7 CONCLUSIONS

The raw water flow measurement systems in the Burlington Water Purification Plant are generally operating consistently and accurately and calibration is performed on a regular basis. Treated water flow measurement, however, has been inconsistent and, therefore, it is recommended that the Region of Halton proceed with its investigation of the accuracy of the treated water flow metering system and make the necessary improvements.

SECTION C

PROCESS COMPONENTS

SECTION C

PROCESS COMPONENTS

C.1 GENERAL

The following sections describe the present treatment process components of the Burlington Water Purification Plant. A plant layout indicating the location of the major process units is included in Drawing No. 2. A general schematic of the Water Plant is provided in Drawing No. 3, and a general process and piping block schematic of the plant operations is provided in Drawing No. 4. (Note: Drawing #4 is included as a fold-out at the back of the Report.)

The Burlington Water Purification Plant operates as a direct filtration plant and the present process components include screening, low lift pumping, flocculation, filtration and high lift pumping with chemical treatment consisting of pre-chlorination and post-chlorination disinfection, coagulation using aluminum sulphate and polymer, fluoridation and, prior to December 1985, chlorine dioxide.

C.2 DESIGN DATA

C.2.1 Capacity

The original water plant was constructed in 1935 and before the major expansion in 1983 had a capacity of approximately 110 ML/d (24 migd). The plant was expanded in 1983 to a rated capacity of 165 ML/d (36 migd) based on the Ontario Ministry of Environment Certificate of Approval but usually operates at 110 ML/d (24 migd) capacity at maximum day and 48 ML/d (11 migd) capacity for average day.

The highest output at the plant was 113.7 ML/d (25 migd) based on the flow data collected over the three year study period 1984-1986.

The plant capacity varies seasonally due to lower lake levels in the winter thus lowering capacity through the gravity intakes.

The 1935, 1950, 1954 and 1956 sections of the plant, i.e. filters 1 - 7, settling basins and high lift pumping station are no longer in service.

C.3 PROCESS COMPONENT INVENTORY

C.3.1 Intakes

The raw water is taken from Lake Ontario on the principle of gravity flow through two intakes. An intake schematic is provided in Drawing No. 5. The older of the two intakes installed in 1953 consists of a 762 mm diameter steel pipe extending 500 m into Lake Ontario, with a 3.7 m^2 intake crib submerged approximately 9.0 m at the winter low lake level of 73.62 metres Canadian geodetic datum. The newer intake pipe was installed in 1962 and consists of an 1500 mm concrete pipe extending 734 m into Lake Ontario with a hexagonal intake crib submerged approximately 9.0 m at the winter low lake level of 73.62 m Canadian geodetic datum. A 1.8 m x 2.1 m box conduit, 73 m in length connects the 1500 mm intake to the raw water well. The concrete raw water well is 14.0 m wide by 23.0 m long by 6.5 m deep and has a volume of 1600 m^3 at top water level. As the level in the raw water well is drawn down by using the low lift pumps, water flows into the well from the lake through the intakes. The capacity of the intakes is limited by the maximum differential head obtainable between the lake and the raw water well. It has been calculated that the capacity of the 1500 mm concrete intake at the summer low lake level is 207,000 m^3/d (45.5 migd). The capacity of the 762 mm steel intake under the same conditions is approximately 50,000 m^3/d (11 migd).

There have been no reported problems of the presence of frazil ice during 1984-1986. At present there are provisions for backwashing the intakes. No chemicals are added directly in the intakes.

C.3.2. Screens

There is one Link-Belt Model 45 travelling water screen, located between the intakes and the raw water well, which is used to prevent large debris, fish, etc., from entering the purification process. The screen is 1.5 m wide and has an overall height of 7.0 m . The screen is driven by a 0.75 kW electric induction motor. The waste from the screens is collected and hauled to a landfill site.

The plant is also equipped with a manual screen and provisions are available for the future addition of a rotating screen. The manual screen has a capacity of 68,200 m^3/d but is used in emergency conditions only. The travelling screen has a capacity of 182,000 m^3/d assuming a maximum head loss of 122 mm through the screen at a minimum summer well level of 1.98 m or 73.000 m elevation. The Model 45 is designed to withstand a maximum difference in head (between the front and back of the screen) of 1524 mm at the maximum water depth.

C.3.3 Low Lift Pumps

The low lift pumping station, consisting of six vertical turbine low lift pumps, transfers water from the raw water well to the raw water header leading to the flocculation tanks and filters.

The six low lift pumps discharge to two main headers leaving the station. The header is split into two lines. The first line originally served filters 1-7. This line is no longer in service. The other main header splits into two 900 mm headers (in the filter building) through filters 8-11 and through filters 12, 13, 14 and 16. Provisions exist for future filters 15 and 17.

Water flows to the flocculation tanks through a 1050 mm concrete pressure pipe raw water transfer main. On entering the filter building, this raw water main divides into two 900 mm stainless steel headers leading to the North and South banks of flocculation tanks. Control for the low lift pumping is based on flocculation conduit level.

The method of raw water flow control is as follows. As the level in the flocculated water conduit rises, the flow control valve associated with the raw water header feeding that particular bank of flocculation tanks closes proportionally to reduce the flow (modulating control valve). If the control valve position is less that 30% then the operator or computer (depending on the control mode selected for these pumps) will shut off the most recently started pump.

As the level in the conduit falls, the flow control valve opens. If the control valve position is greater than 70% then the next duty pump is started.

Pump duty selection may be varied by the plant operator through the process computer.

A summary of the existing low lift pumps is presented in Table C1.

TABLE C1

BURLINGTON WATER PURIFICATION PLANT SUMMARY OF LOW LIFT PUMPING UNITS

Pump No.	Manufacturer	Type	Year of Purchase	Capacity m^3/d (migd)	Head m (ft.)	Motor Voltage	kW
1	Layne & Bowler	Vertical Turbine	1956	26,363 (5.8)	12.8 (42)	550	37.5
2	Byron Jackson	Vertical Turbine	1955	22,273 (4.9)	12.5 (41)	550	7.5
3	Worthington	Vertical Turbine	1961	34,091 (7.5)	12.2 (40)	550	75
4	Worthington	Vertical Turbine	1965	54,545 (12)	17.1 (56)	4160	150
5	Peerless	Vertical Turbine	1977	90,909 (20)	10.1 (33)	4160	225
6	Layne & Bowler	Vertical Turbine	1965	40,909 (9.0)	15.2 (50)	550	94

The total installed station capacity is 269,000 m^3/d (59.2 migd) and the firm station capacity is 178,000 m^3/d (39.2 migd). A raw water low lift schematic is included in Drawing No. 6. Pump No. 3 is dual electric/diesel driven (Waukesha L5792 direct drive Diesel engine) capable of a capacity of 34,091 m^3/d (7.5 migd). Under standby power mode, the low lift diesel generator set can supply power to all of the 550 volt pumps (1,2,3 and 6) with a total capacity of 123,636 m^3/d (27.2 migd). Failure of the Diesel generator would result in the direct drive unit on pump No.3 starting.

C.3.4. Flash Mixing

Flash mixing is accomplished by an in-line blender located at the discharge of the low lift pumping station, at a point immediately north of where the discharge headers meet, i.e., downstream of the pumping station. The in-line blender is an Instomix Model SH-0768, manufactured by Walker Process. The unit is 1067 mm in diameter, 1.2 m in length, and is fabricated of standard weight steel pipe with welded flanged ends. The blender is powered by a 0.75 kW motor. The two impellers are 297 mm diameter 316 stainless steel. The calculated

G valve is 730 sec^{-1} and Gt values are 560 at 120,000 m^3/day and 900 at 75,000 m^3/day.

C.3.5 Flocculation

There are three concrete flocculation tanks, each with six chambers (two banks of three chambers each). Each chamber is approximately 4.85 m long x 4.85 m wide with a 7.9 m depth and has an effective volume of approximately 173 m^3. This results in a volume of 520 m^3 per pass or 1040 m^3 per tank. Each flocculation tank can be operated independently in order that one tank can be emptied for maintenance. It is not necessary that both banks of chambers in each tank be used. Water is introduced tangentially at the bottom of the first chambers and flows upward. The spiral flow is maintained by staggered horizontal wood baffles. Water exits the first chamber through a 750 mm circular downpipe to the second chamber, where it enters tangentially. The second to third chamber route is similar.

Tapered flocculation (decreasing velocity gradient) through each set of tanks is accomplished by increased opening size at the entrance to consecutive tanks, thereby reducing hydraulic loss, i.e. imparting less energy on entrance to successive tanks.

The raw water is pumped from the low lift station to the flocculation tanks through the 1050 mm raw water header. Just prior to the tanks, the flow is split into two 900 mm stainless steel headers. Two parallel and independent flocculation systems are provided, comprised of two flocculation tanks on the south side of the plant and one flocculation tank on the north side. Flow to each side of the plant is regulated as described in C.3.3.

Table C2 summarizes the detention time at rated plant capacity of 165 ML/d for all three flocculation tanks, (total volume = 1040 m^3 x 3 = 3120 m^3), and approximate velocity gradients calculated based on the formula for hydraulic mixing and flow through both ports in the flocculation tanks.

TABLE C2

BURLINGTON WATER PURIFICATION PLANT
FLOCCULATION DETENTION TIME AND G VALUES

FLOW (m^3/day)	DETENTION TIME (min)	VELOCITY GRADIENTS (G) CELL 1 (sec^{-1})	CELL 2 (sec^{-1})	CELL 3 (sec^{-1})	OVERALL G_t
165,000	27.2	40	25	15.9	4.7×10^4

When the flow anticipated for the day is low, standard operating procedure is to bypass one or more flocculation tanks, to maintain approximately a 30-minute detention time. This ensures that the flocculation energy gradients are maintained at the design values indicated in the table above.

C.3.6 Sedimentation

Sedimentation has not been utilized at the Burlington Water Purification Plant since the recent expansion completed in 1983.

C.3.7. Filters

Flocculated water passes into either the North or South flocculated water conduit, one servicing filters 9, 11 and 13, the other servicing filters 8, 10, 12, 14 and 16. An interconnection is provided from the South to North conduits at the east end of the filtration building. This interconnection (a 500 mm polyethylene pipe) is intended only for emergency use since its hydraulic capacity is approximately 3 mgd. It is used only if the North filters are in service with the South flocculation tanks in use, or vice versa, i.e. for special maintenance procedures.

Each filter has a 1200 mm high by 600 mm raw water influent sluice gate in these flocculated water conduits.

Eight filters are presently in use at the Burlington Plant. Four were constructed in 1962 and have a bed area of 94 m^2 each. The remaining four, built in 1980, have a bed area of 130 m^2 each. The filters are constructed of concrete and the filter media consists of a 450 mm layer of anthracite above a 300 mm layer of sand.

The analysis of core samples reported in the 1988 report by Gore and Storrie Limited, entitled "Evaluation of Process Components - Phase 1" indicates that filter 14 (representative of the most recently constructed filters) had 300 mm of anthracite, effective size 0.74 mm and uniformity coefficient 1.42, 50 mm of mixed anthracite and sand, and 300 mm of sand, effective size 0.57 mm and uniformity coefficient 1.32. At the time of construction, this filter contained 300 mm sand and 450 mm anthracite (as did filter 12, 13, and 16).

Filters 9 and 11 contained 50 - 75 mm mixed anthracite and sand, and another 450 - 500 mm sand, effective size 0.58 and 0.65 respectively, and uniformity coefficients 1.48 and 1.55 respectively.

The support media consists of 300 mm of gravel in the following thicknesses:

50 mm of 1.19 - 2.38 mm
75 mm of 3.36 - 6.35 mm
75 mm of 6.35 - 12.7 mm
100 mm of 12.7 - 19 mm

The filter underdrain material is unglazed vitrified fired clay pipe, commonly known as the Leopold underdrain system. It comprises a total depth of 250 mm.

Each of the 1962 filters is rated for a capacity of 200 mL/s (2640 igpm) and each of the 1980 filters is rated for a capacity of 300 mL/s (3960 igpm). All eight filters have a total rated capacity of 173 ML/d (26,400 igpm).

Table C3 summarizes the design filter rates for the four smaller and four larger filters at the plant. MOE design guidelines suggest a maximum filtration rate of 12.0 m/h (4.3 gpm/ft^2).

TABLE C3

BURLINGTON WATER PURIFICATION PLANT
FILTER RATES

FILTER AREA m^2	(ft^2)	FLOW RATE ML/d	(igpm)	FILTER RATE m/h	(igpm/ft^2)	TOTAL FLOW ML/d
94	(1012)	17.3	(2640)	7.7	(2.61)	69.2
130	(1400)	25.9	(3960)	8.3	(2.83)	103.6

The filter influent sluice gates and back wash sluice gates are equipped with electric actuators that are controlled by the process computer. The filter system operates in the same manner whether under local, remote/local, or remote/CPU control. The filters may be controlled by the operator or automatically by the computer. Level in the flocculated water conduit is transmitted to the main filter building control panel.

A filter operational study is presently being carried out for all eight filters. The design elevations for the filters are as follows:

top of box	81.991 m
top of water	81.600 m
top of trough	81.206 m
top of anthracite	79.175 m
top of sand	78.725 m
top of gravel	78.425 m
top of underdrain	78.125 m
bottom of box	77.875 m

Table C4 contains filter data for turbidity, flow and backwash rates.

Two backwash pumps are provided for the cleaning of the filters. The four smaller filters require only one backwash pump for cleaning. Each backwash pump has a rated capacity of 86 400 m^3/d against a head of 10.7 metres. The backwash cycle for the four larger filters typically consists of three minute low wash at 15-44 m/h with one pump followed by a ten minute high wash at 66-84 m/h with both pumps, then a two minute low wash. The backwash pump located in the new pipe gallery is powered by a 150 kW motor, whereas the

TABLE C4

BURLINGTON WATER PURIFICATION PLANT
FILTER DATA

Raw Water Turbidity Range (FTU)	0.48-62.0 based on daily averages of 9 readings per day (3 readings per 8 hr.shift). Readings obtained by operators using Hach turbidimeter
Effluent Turbidity Ranges (FTU)*	0.08-1.20 based on daily averages of 9 readings per day (3 readings per 8 hr. shift).Readings obtained by operators using Hach turbidimeter
Length Of Filter Run	12-24 hrs. based on summer raw water quality and average flows
Headloss (Clean Bed/Dirty Bed)	0.6-2.0 m

Filtration Rate

	Total Flow	Filters 8-11	Filters 12,13,14,16
Flowrate	110 ML/d	7.7 m/h	8.3 m/h

Backwash Flow	low wash 300 L/s for 3 mins (1 pump) high wash 800 L/s for 10 mins (2 pumps) low wash 300 L/s for 2 mins (1 pump)
Filtered Water/Cycle	104-622 m^3/m^2 range
Backwash Water/Wash	11.5 m^3/m^2 average (larger filters) 7.6 m^3/m^2 average (smaller filters)

* *In addition to turbidity measurements taken by plant operators, there are eight filter effluent turbidity sample lines (one for each filter) with a continuous reading turbidimeter that samples each filter every 40 minutes for 5 minutes. The 4-20 mA output from this turbidimeter is connected to the central computer via the low lift RTU.*

backwash pump located in the old pipe gallery is powered by a 187.5 kW motor.

The backwash pumps take filtered water from the clearwell and pump it upwards through the filter. The amount of water used in the backwash process varies, but is generally around 4% of the filtered water.

Backwash is initiated upon headloss, turbidity breakthrough or time of the filter run as explained in the Plant Operation Section. Discharge from each backwash pump is metered and the amount of water used in the backwash process is recorded and totalized by the process computer.

The backwash sequence and logic control is handled by the RTU in the filter gallery. Filter wash is initiated manually while all other functions are handled by automatic control programs resident in the filter/wash RTUs.

The control panels local to each filter may also be used for a completely manual wash, i.e. individual open/close operations of every valve or sluice gate in the filter.

There are three separate clearwells, as shown on Drawing No. 10. One clearwell (Cell 1) is below filters 8 and 10; one clearwell (Cell 2) is below filters 9 and 11; and the third clearwell (Cell 3) is below filters 12, 13, 14, and 16.

Cells 1 and 2 are each approximately 16 m x 14 m, and Cell 3 is an irregular shape, approximately 20 m x 35 m plus 20 m x 15 m. Based on the design top water levels in the clearwells, their total volume is approximately 4,200 m^3.

Water from Cells 1 and 2 flow through separate conduits, west to east, into a common chamber. Water from Cell 3 flows into the same chamber, then through a flume below the clearwell Cell 3 into the high lift pumping station suction wells.

The level of water in the clearwell(s) is used to control the filtration rate of filters feeding the clearwell below as follows. When the level of water in the clearwell is more than 300 mm below the design top water level, the filter effluent rate controller modulates the filter effluent valve to maintain the pre-set filter rate of flow.

When the level of water in the clearwell enters the top 300 mm band, the pre-set filter rate is 'over-ridden'. The rate control valve controller then receives a control signal based on level only in the upper 300 mm band, and as the level rises the effluent valve is closed proportionately until it is shut off when the clearwell is full. As the level drops in this 300 mm band the valve opens, until the level falls out of the 300 mm band at which time the pre-set filter rate resumes and maintains effluent flow.

C.3.8 High Lift Pumps

The high lift pumps draw treated water from the east and west suction wells and pump it to Zone 1 of the distribution system. The high lift pumping station is located adjacent to the filter building. There are six high lift horizontal split case pumps as described in Table C5.

TABLE C5

BURLINGTON WATER PURIFICATION PLANT
HIGH LIFT PUMPS

PUMP NO.	MAKE	YEAR OF PURCHASE	TYPE	CAPACITY m^3/d (migd)	HEAD m (ft.)	kW
1	Ingersoll-Rand	1978	Horizontal Split Case	45 000 (9.9)	70.1 (230)	450
2	Ingersoll-Rand	1978	Horizontal Split Case	91 000 (20.0)	70.1 (230)	825
3	Ingersoll-Rand	1978	Horizontal Split Case	91 000 (20.0)	70.1 (230)	825
4	Allis-Chalmers	1967	Horizontal Split Case	27 000 (5.9)	64 (210)	300
5	Allis-Chalmers	1962	Horizontal Split Case	39 000 (8.6)	67 (220)	375
6	Ingersoll-Rand	1978	Horizontal Split Case	45 000 (9.9)	70.1 (230)	450

Based on the above, the high lift station capacity can be calculated as follows:

1. Total Station Capacity: 338,000 m^3/day (74.4 migd)
2. Firm Station Capacity: 247,000 m^3/day (54.3 migd) (largest pump out of service).

Control for the high lift pumping station is dictated by the water distribution demand. If the system is in automatic mode, pumps will be started and stopped as required. If the system is in manual mode, pumps must be started by manual control to the keyboard.

The pumps will automatically be shut down if one of the following conditions does not permit the pumping unit to be operated under satisfactory conditions:

1. pressure outside a pre-determined limit
2. insufficient suction pressure
3. insufficient flow

Presently, the total standby capacity is 91 000 m^3/d. Pump No. 3 is equipped with a dual diesel/electric drive and Pump No. 2 has provisions for a diesel drive to be added if required. Based on this rate and, as indicated by the water production requirements and daily flows in Tables 1.0 and 1.1, in the Appendix, there is sufficient standby capacity to meet the requirements of the high lift station of the water purification plant. A high lift pumping station schematic is provided in Drawing No. 11.

C.3.9 Backwash Treatment & Sludge Disposal

The filter backwash is treated through the on site wastewater treatment system which consists of a waste holding tank, air diffusers, an overflow to Lake Ontario, and a discharge to Sewage Pumping Station No. 9. Discharge of wash water with a solids concentration in excess of 15 mg/L is not permitted. A report entitled "Water Purification Plant Waste Disposal for Burlington, Ontario" was prepared by Simcoe Engineering Limited and the Region of Halton and provides a detailed account of the backwash treatment.

Waste from this plant will be of two types:

1. Material collected in the intake screen;
2. Filter backwash water.

The material collected on the screen, such as fish and large debris, are packed in heavy duty bags and hauled to a landfill site. These items are too coarse for disposal through the regular sewage system.

The waste holding tank is located partially underground at the south end of the building. The tank is 29.2 m long x 15.8 m wide and 5.7 m deep, with an effective volume of 2620 m^3. The waste holding tank contains surges caused by the backwashing of the filters.

Backwash from the filters is discharged to a 900 mm stainless steel pipe encased in concrete from two locations; one discharge from filters 9,11, and 13, the other discharge from filters 8,10,12,14, and 16.

This waste transfer line has an isolating valve which when open allows wastewater to flow directly to the lake. When closed, wastewater is diverted through a flap valve into the waste holding tank. The isolating valve is controlled (open or closed) by the wastewater turbidity, so that only wastewater with a turbidity below 15 FTU goes to the lake.

An air header system using compressors as an air source keeps solids in suspension in the waste holding tank. There are four sets of air diffusers located 10 m apart. Each set consists of two 7 m lengths running the width of the tank. The headers are 75 mm diameter Sch.80 PVC pipe with drilled holes on the bottom. The diffuser air discharge range is 5.6 L/s (12 cfm) per diffuser.

Monitoring of the level in the waste holding tank is accomplished by an ultrasonic device. The level is indicated at the main control room. The air diffusers operate based on the level in the tank.

The rate of flow out of the waste holding tank is controlled by a modulating valve positioned according to the level in the No. 9 Sewage Pumping Station wet well which is measured by an ultrasonic device. Wastewater is siphoned, not pumped, out of the waste holding tank by suction created by a 300 mm pipe flowing outside of the waste holding tank. When the level in the No. 9 Sewage Pumping Station is full, the wastewater flow from the waste holding tank is zero. The rate of flow out of the waste holding tank is measured by a magnetic flow meter.

C.4 CHEMICAL SYSTEMS

The present chemical facilities are comprised of the storage and dispensing of chlorine gas, aluminum sulphate (alum), polyelectrolyte (polymer) and hydrofluosilicic acid (fluoride). Until December, 1985 the chemical facilities also included sodium chlorite.

All liquid chemical systems operate in a flow-paced mode where the speed of the metering pump is automatically varied to match the flow of water under treatment at the point of injection. For example, alum and polymer pumps are paced by low lift total flow; fluoride by high lift discharge flow. 4-20 mA signals generated by the plant flow meters are used through Beel SCR drives to modulate pump speed. The stroke of each pump can be adjusted remotely by a stroke position potentiometer (fed by a 4-20 mA output signal from the computer generated in response to a manually entered dosage value) to provide the desired dosage.

C.4.1 Chlorine

Chlorine is used in the water treatment process for the disinfection of the water supply. Chlorine also serves to control taste and odour problems, prevent algae and slime growth, destroy phenols and hydrogen sulphide, oxidize manganese, nitrite and ammonia, and maintain a clean filter media.

Chlorine gas is used as the source of chlorine at the Burlington Water Plant and is delivered and stored in one tonne cylinders in the chemical building. A pre-chlorination and post-chlorination summary is contained in Tables 3.0, 3.1, and 3.2 in the Appendix.

- Pre-chlorination (by the addition of chlorine gas)

Pre-chlorination is a controlled dosage of chlorine added during the pre-treatment stages of the water treatment process. Chlorine is added to the water prior to flocculation via diffusers in the raw water well.

The pre-chlorinator is a Pennwalt Wallace & Tiernan Model U25016 V-notch, V-800 series variable feed vacuum gas type chlorinator with a 907 kg/d (2000 lb/d) capacity. The pre-chlorinator can supply 7.37 mg/L at a flow of 123,000 m^3/d which is the maximum day raw water pumpage recorded at the plant. Based on past records of chlorine demand, the chlorinator is sufficient in size to meet the present maximum day chlorine demand of the raw water.

The stand-by chlorinator is identical to the pre-chlorinator, and can supply chlorine to either the pre-chlorination or post-chlorination systems.

The chlorine feed lines are Sch.80 PVC pipe, 25 mm diameter from the vacuum regulators to the chlorinators. From the pre-chlorinators to the rotameters and diffusers, the chlorine solution line is 50 mm diameter.

The chlorinator uses a manually input setpoint originating from the computer in response to a setpoint entered by the operator. The Chlorinator is paced to flow. The residual is displayed in the control room and as the residual varies from the desired value, the operator adjusts the dosage setpoint accordingly.

The chlorine system is located in two rooms in the chemical building on the south side of the building. The chlorine cylinders are stored on trunnion rollers in the chlorine storage room. There is storage for 24 cylinders plus 3 spares. The weigh scale equipment is also located in this room. The metering pumps, chlorinators and analyzers are located in an adjacent room.

Under normal operation the required chlorine is drawn directly from four - 1 tonne cylinders by vacuum through a remote vacuum regulator to the chlorinators. The chlorine system operates under computer control. The computer also monitors the chlorine tank weights and pressure and will send a low chlorine pressure alarm back to the RTU.

The Wallace & Tiernan electric positioner provides for metering control in response to 4-20 mA dc signals over an operating range of 10:1 and a dosage range of 25 to 200%.

The Brooks Sho-Rate "75" rotameter Model 1305-6221 Flowmeter for chlorine dilution water has a capacity of 2 L/min (0.44 igpm).

- **Post-Chlorination (by the addition of chlorine gas)**

Post-chlorination facilities are provided in order that further adjustments to the chlorine residual can be made, if required, prior to the water entering the distribution system. The post-chlorinator is a Pennwalt Wallace & Tiernan Model U26012 V-notch V-800 series variable feed vacuum gas type chlorinator with a daily capacity of 227 kg (500 lbs.). At a plant flow of 165 ML/d (36 migd), the post-chlorinator can provide up to 1.4 mg/L dosage. Since the post-chlorine dosages are normally less than 1 mg/L, the post-chlorinator has sufficient capacity.

Post-chlorination takes place as the filtered water leaves the clearwells and is in the finished water influent channel, prior to entering the high lift suction wells.

Post-chlorination is automatically controlled by the computer similar to pre-chlorination. The post-chlorination feed lines are Sch.80 PVC pipe 40 mm in diameter from the post-chlorinator to the rotameters and diffusers.

The storage facilities for the chlorine used for post-chlorination is the same as those for pre-chlorination. The electric positioner and rotameter for the post-chlorination system is the same as for the pre-chlorination system.

C.4.2. Aluminum Sulphate

Liquid aluminum sulphate is added through the chemical feed ports of an in-line blender in the raw water header (see Drawing #8). Aluminum sulphate is used as the primary coagulant to de-stabilize any colloidal suspensions present in the raw water (turbidity) and, through the flocculation process, to agglomerate the suspended particles to the appropriate size for the following treatment stages. Three chemical metering pumps manufactured by Pennwalt Wallace & Tiernan, each with a maximum output capacity of 5680 L/d are used to feed alum. Each pump is Series 44, with a maximum discharge pressure of 75 kPa (125 psi) and powered by a 0.375 kW, 1750 RPM motor. At a plant flow of 165 ML/d (36 migd), the alum pumps can provide up to 22.5 mg/L dosage.

The aluminium sulphate storage consists of two wood-stave, PVC lined sulphate solution tanks each of 40 m^3 capacity. The tanks are closed top with vent drain and sight glass. They are located in the chemical building. Both tanks are contained by a concrete berm but the berm is not large enough to contain the entire contents of the tanks. Each tank has a separate fill line which runs from the tank to the loading dock at the south-west side of the chemical building. Shut-off valves and tank level indicators are located near the dock.

In general, the alum system operates under computer control. The speed of each pump automatically changes in proportion to the flow of water through the blender, i.e. raw water flow. The stroke of each pump is varied when the chemical dosage needs to be altered. The Brooks Sho-Rate "75" rotameter for alum dilution water has a capacity of 83.3 L/min (18.3 igpm).

Alum dosage is selected based on laboratory scale jar-testing and visual inspection with adjustments made to reflect the differences between test results and plant performance.

C.4.3 Polymer

The liquid polymer (Catfloc T as supplied by Calgon) is introduced to the raw water through the in-line blender at the same location as the aluminum sulphate namely in the east raw water header prior to the flocculation tanks. Two Pennwalt Wallace & Tiernan Series 44 chemical metering pumps, each with a capacity of 167 L/d, are used to feed the polymer. The maximum discharge pressure of each pump is 1035 kPa (150 psi) and each pump is powered by 0.188 kW, 1750 RPM motor. At a plant flow of 165 ML/d (36 migd), the polymer pumps can provide up to 1.0 mg/L dosage.

The entire polymer system is located within the polymer room of the chemical building. Polymer is delivered and stored in 204 kg (450 lb) plastic lined drums. The chemical pumps transfer the liquid polymer directly from the drums to the application point. A sonic level transmitter positioned above the drum sends a level reading and low alarm signal to the polymer RTU.

The system also contains a Brooks Sho-Rate "75" rotameter for dilution water. The capacity is 25 L/min (5.5 igpm).

Under normal operation, the liquid polymer system operates under computer control. The speed of each pump is paced to flow, i.e. it automatically changes in proportion to the flow of water at the point in which the polymer is injected. The pump stroke is manually set by plant operators (remotely by the computer and a stroke positioner on each pump) to produce the desired dosage.

Polymer is added at approximately a 10:1 aluminum sulphate to polymer ratio to aid in coagulation and flocculation. The actual dosage amounts vary with the raw water quality. The polymer dosage required for effective treatment can only be determined by evaluation of the process performance at any time, however, typically "low turbidity" operation will require polymer dosage in the range of 0.2 to 0.5 mg/L.

Some years ago, for a short period, the raw water turbidity was high and 'very fine' and experimentally a polymer dosage in the range 0.5 - 1.0 mg/L was applied. Filters 9 and 11 are reported to have exhibited clumping of the media, probably as a result of this experimental procedure.

C.4.4 Fluoride

Fluoride, in the form of hydrofluosilicic acid, is added in the finished water channel immediately prior to the high lift station. The flow diagram is provided in Drawing No. 9.

Two Pennwalt Wallace and Tiernan Series 44 metering pumps located in the fluoride room in the chemical building, each with a capacity of 1919 L/d, are used for acid feed. At a plant flow of 165 ML/d (36 migd), the fluoride pumps can provide up to 2.9 mg/L dosage. The hydrofluosilicic acid is stored in a 40 m^3 wood-stave, PVC lined, closed top tank. The tank has a fill line that runs from the tank to the loading dock at the southwest side of the chemical building.

Shut-off valves and level indicators are located near the dock.

Fluoride feeds are designed to obtain a residual of less than 1.2 mg/L in the finished water. Residual readings at the plant are usually 1.0 mg/L± based on the three years of data available.

C.5 SAMPLING

The plant is equipped with sampling lines for raw water, treated water, the pre-chlorine analyzer, the post-chlorine analyzer and filter effluent turbidity (from each filter).

The raw water sample line is a 316 stainless steel pipe that runs from the raw water intake conduit before the screens to the plant laboratory. This sample line runs on a continuous basis. The raw water is analyzed for temperature, pH, ammonia and turbidity by the operators.

The treated water sample line is a 316 stainless steel pipe that runs from the high lift pumping station header to the plant laboratory. This sample line runs on a continuous basis. The treated water is analyzed for temperature, pH, ammonia, turbidity, aluminum residuals, fluoride residual, and post-chlorine residual by the operators.

The pre-chlorine analyzer is fed by a PVC sample line on a continuous basis. The sample line draws the water from the raw water header prior to the flocculation tanks. The pre-chlorine analyzer is located in the chlorine room of the chemical building.

The post chlorine analyzer is fed by a PVC sample line on a continuous basis by a sample pump. The sample line draws water from the high lift discharge header to the post-chlorine analyzer located in the chemical building.

The filter effluent turbidity sample lines are black PVC. There are eight sample lines, one for each filter. A solenoid valve controls the sampling process whereby each line is run for five minutes per cycle. Each filter is therefore sampled once every forty minutes. The filter effluent turbidity is automatically entered into the process computer. The turbidity monitoring panel is located in the low lift pumping station.

Table C6 details line sizes, flows, etc. All sample lines flow at a constant rate.

C.6 PROCESS AUTOMATION

The supervisory control and data acquisition system for the Burlington Water Purification Plant controls and supervises all aspects of the treatment plant and remote pumping stations using a fully distributed intelligence system. This system of computer-based terminal units provides the operation staff with the necessary information and tools to operate the plant with maximum efficiency.

The control room contains two Nova 4-X minicomputers which provide the operators with multi-coloured graphic displays at the main console, and provide information to water operations management staff via telephone links to Regional offices.

C.7 STANDBY POWER

During any potential power interruptions or electrical emergencies that occur plant operations can continue. A 825 kW direct drive diesel operates high lift pump 3 at a capacity of 91 000 m^3/d (20 migd).

A separate 450 kW diesel generator set provides emergency stand-by power to the raw water and washwater pumps, as well as all chemicals and control systems.

The central computer has a separate back-up power supply system.

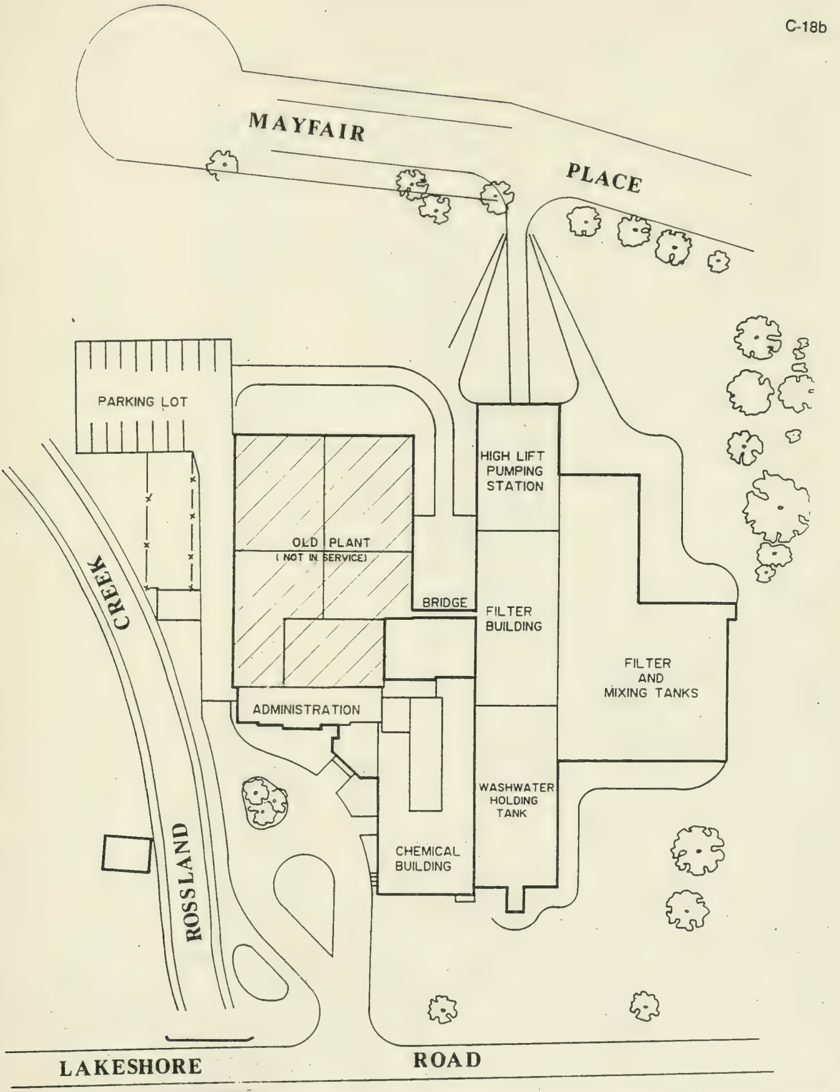
TABLE C6

BURLINGTON WATER PURIFICATION PLANT

SAMPLING SYSTEMS

SOURCE	LENGTH/SIZE m/mm	FLOW L/min	VELOCITY m/s	TRAVEL TIME min
RAW WATER	30/25	10.0	0.34	1.5
TREATED WATER	90/12.5	6.5	0.88	1.7
PRE-CHLOR.	35/19	9.0	0.53	1.1
POST-CHLOR.	90/19	9.0	0.53	2.8
FILTERS	*80/12.5	5.0	0.68	*2.0

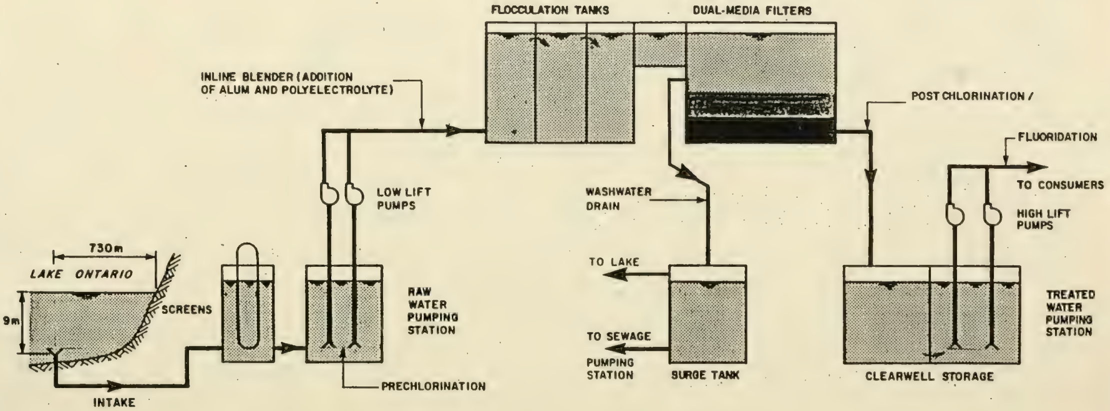
** Average value for 8 filters*



Drawn By
Date
Scale
Date

WATER PLANT LAYOUT

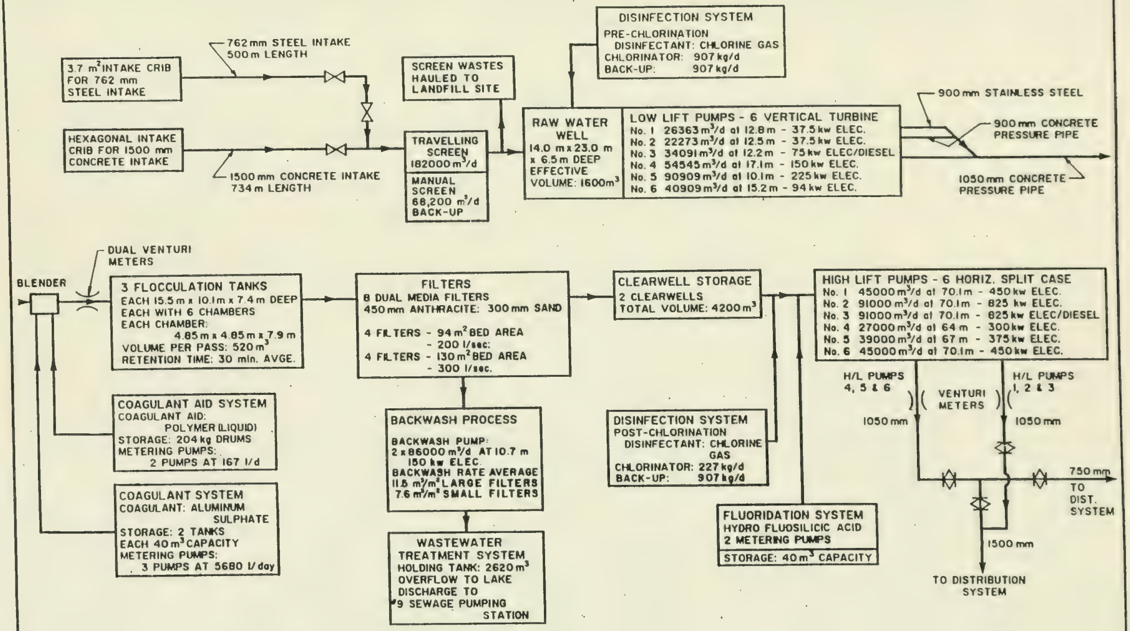
Dwg No 2



BURLINGTON WATER PURIFICATION PLANT • SCHEMATIC FLOW DIAGRAM

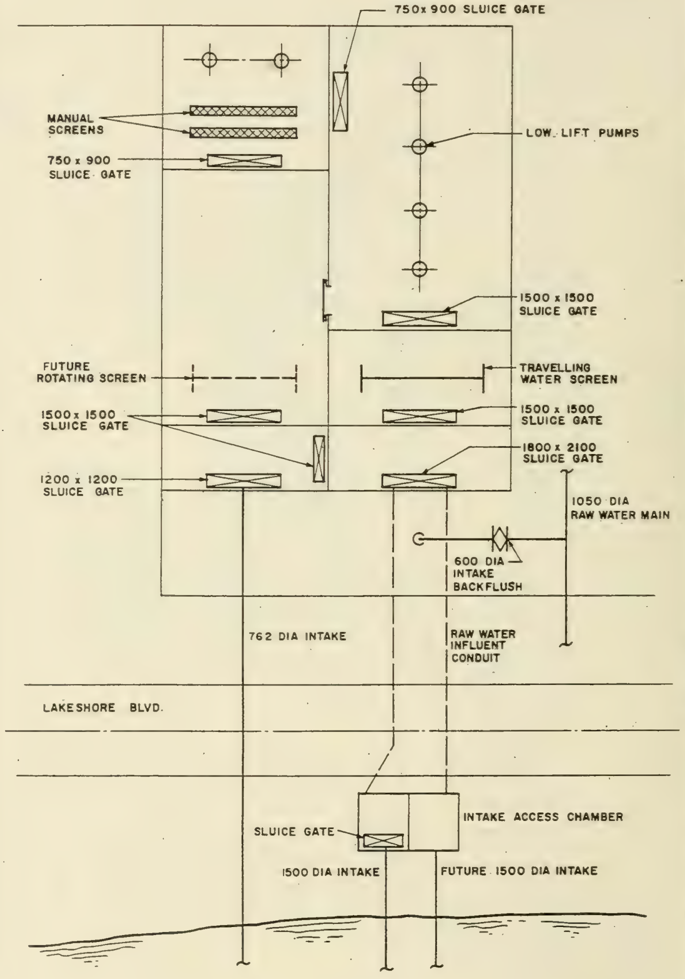
FILE No 10881-A3-543

DWG. No. 3


3.7 m² INTAKE CRIB FOR 762 mm STEEL INTAKE
762 mm STEEL INTAKE 500 m LENGTH
HEXAGONAL INTAKE CRIB FOR 1500 mm CONCRETE INTAKE
1500 mm CONCRETE INTAKE 734 m LENGTH
SCREEN WASTES HAULED TO LANDFILL SITE
TRAVELLING SCREEN 182000 m³/d
MANUAL SCREEN 68,200 m³/d BACK-UP
DISINFECTION SYSTEM
PRE-CHLORINATION
DISINFECTANT: CHLORINE GAS
CHLORINATOR: 907 kg/d
BACK-UP: 907 kg/d
RAW WATER WELL
14.0 m x 23.0 m x 6.5 m DEEP
EFFECTIVE VOLUME: 1600 m³
LOW LIFT PUMPS - 6 VERTICAL TURBINE
No. 1 26363 m³/d at 12.8 m - 37.5 kw ELEC.
No. 2 22273 m³/d at 12.5 m - 37.5 kw ELEC.
No. 3 34091 m³/d at 12.2 m - 75 kw ELEC/DIESEL
No. 4 54545 m³/d at 17.1 m - 150 kw ELEC.
No. 5 90909 m³/d at 10.1 m - 225 kw ELEC.
No. 6 40909 m³/d at 15.2 m - 94 kw ELEC.
900 mm STAINLESS STEEL
900 mm CONCRETE PRESSURE PIPE
1050 mm CONCRETE PRESSURE PIPE
BLENDER
DUAL VENTURI METERS
3 FLOCCULATION TANKS
EACH 15.5 m x 10.1 m x 7.4 m DEEP
EACH WITH 6 CHAMBERS
EACH CHAMBER:
4.85 m x 4.85 m x 7.9 m
VOLUME PER PASS: 520 m³
RETENTION TIME: 30 min. AVGE.
COAGULANT AID SYSTEM
COAGULANT AID:
POLYMER (LIQUID)
STORAGE: 204 kg DRUMS
METERING PUMPS:
2 PUMPS AT 167 l/d
COAGULANT SYSTEM
COAGULANT: ALUMINUM SULPHATE
STORAGE: 2 TANKS
EACH 40 m³ CAPACITY
METERING PUMPS:
3 PUMPS AT 5680 l/day
FILTERS
8 DUAL MEDIA FILTERS
450 mm ANTHRACITE: 300 mm SAND
4 FILTERS - 94 m² BED AREA - 200 l/sec.
4 FILTERS - 130 m² BED AREA - 300 l/sec.
BACKWASH PROCESS
BACKWASH PUMP:
2 x 86000 m³/d AT 10.7 m
150 kw ELEC.
BACKWASH RATE AVERAGE
11.5 m³/m² LARGE FILTERS
7.6 m³/m² SMALL FILTERS
WASTEWATER TREATMENT SYSTEM
HOLDING TANK: 2620 m³
OVERFLOW TO LAKE
DISCHARGE TO
#9 SEWAGE PUMPING STATION
CLEARWELL STORAGE
2 CLEARWELLS
TOTAL VOLUME: 4200 m³
DISINFECTION SYSTEM
POST-CHLORINATION
DISINFECTANT: CHLORINE GAS
CHLORINATOR: 227 kg/d
BACK-UP: 907 kg/d
FLUORIDATION SYSTEM
HYDRO FLUOSILICIC ACID
2 METERING PUMPS
STORAGE: 40 m³ CAPACITY
HIGH LIFT PUMPS - 6 HORIZ. SPLIT CASE
No. 1 45000 m³/d at 70.1 m - 450 kw ELEC.
No. 2 91000 m³/d at 70.1 m - 825 kw ELEC.
No. 3 91000 m³/d at 70.1 m - 825 kw ELEC/DIESEL
No. 4 27000 m³/d at 64 m - 300 kw ELEC.
No. 5 39000 m³/d at 67 m - 375 kw ELEC.
No. 6 45000 m³/d at 70.1 m - 450 kw ELEC.
H/L PUMPS 4, 5 & 6
H/L PUMPS 1, 2 & 3
VENTURI METERS
1050 mm
1050 mm
750 mm
TO DIST. SYSTEM
1500 mm
TO DISTRIBUTION SYSTEM

BURLINGTON WATER PURIFICATION PLANT
OPTIMIZATION STUDY
M.O.E. PROJECT No. 7 - 2017 DWG. No. 4

FILE No 100 54-A4-403

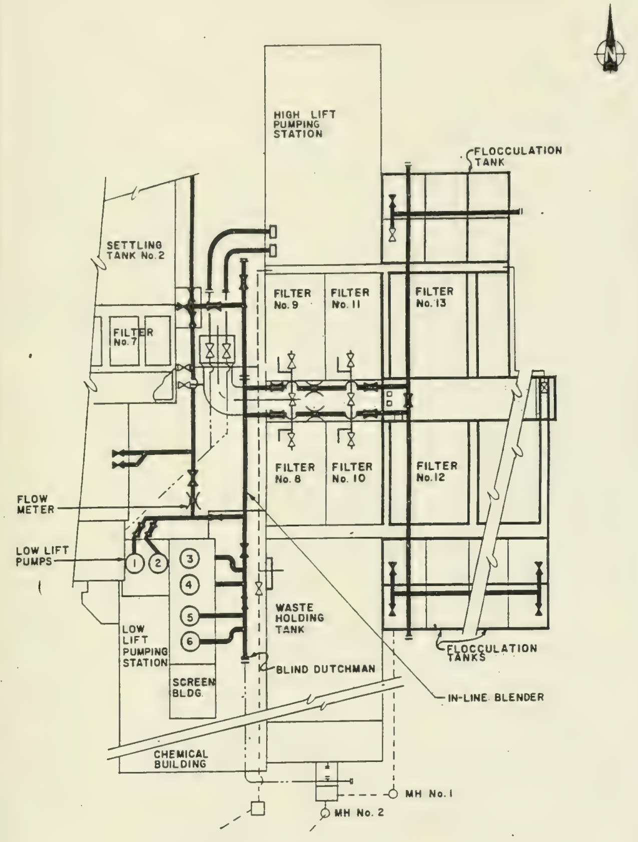


Drawing Title:
INTAKES

Scale:
Date:
Dwg No 5

Drawn:
Design:
Checked:

Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

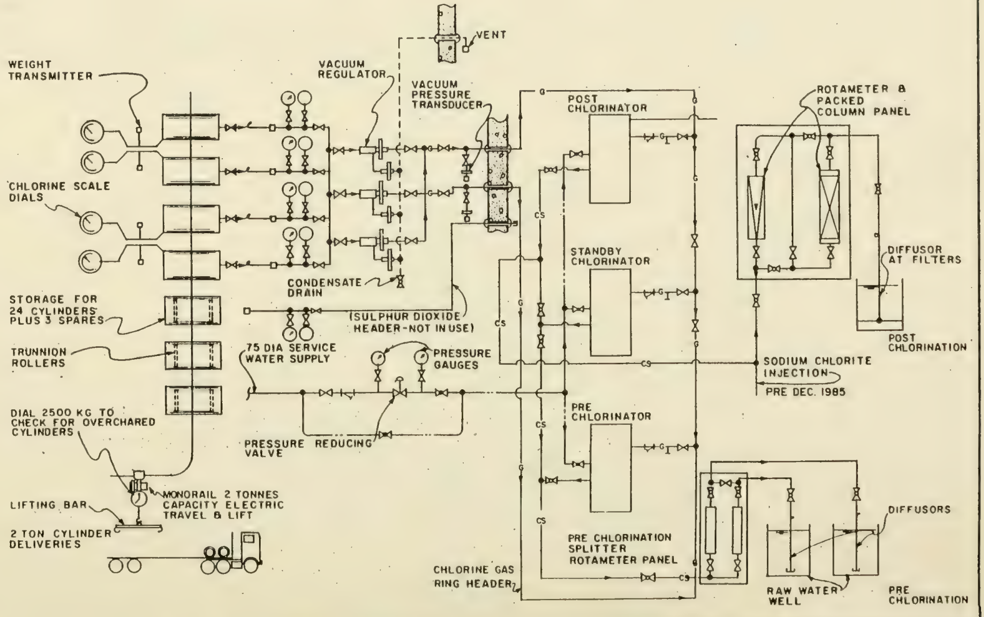


Drawing Title:
BURLINGTON W.P.P.
RAW WATER AND
LOW LIFT PIPING DIAGRAM

Drawn:
Design
Checked
Date
Scale
Dwg No 6
100 54-44-405

Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

No	Revisions	By	Date


VENT
WEIGHT TRANSMITTER
VACUUM REGULATOR
VACUUM PRESSURE TRANSDUCER
POST CHLORINATOR
ROTAMETER & PACKED COLUMN PANEL
CHLORINE SCALE DIALS
DIFFUSOR AT FILTERS
STANDBY CHLORINATOR
CONDENSATE DRAIN
STORAGE FOR 24 CYLINDERS PLUS 3 SPARES
(SULPHUR DIOXIDE HEADER-NOT IN USE)
POST CHLORINATION
TRUNNION ROLLERS
75 DIA SERVICE WATER SUPPLY
PRESSURE GAUGES
SODIUM CHLORITE INJECTION
PRE DEC. 1985
PRE CHLORINATOR
DIAL 2500 KG TO CHECK FOR OVERCHARED CYLINDERS
PRESSURE REDUCING VALVE
MONORAIL 2 TONNES CAPACITY ELECTRIC TRAVEL & LIFT
LIFTING BAR
DIFFUSORS
2 TON CYLINDER DELIVERIES
PRE CHLORINATION SPLITTER ROTAMETER PANEL
CHLORINE GAS RING HEADER
RAW WATER WELL
PRE CHLORINATION
G
CS

Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

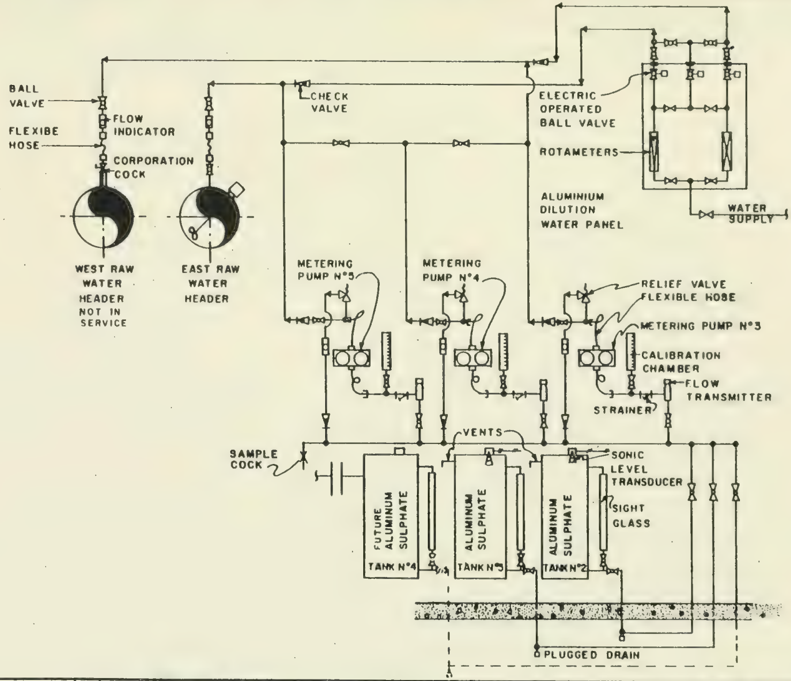
No.	Revisions	By	Date

Drawn: DK
Design:
Checked: GB

Drawing Title:
BURLINGTON W.P.P.
CHLORINE SCHEMATIC

Date:
Scale.
Dwg No 7

File No 10881-A3-164



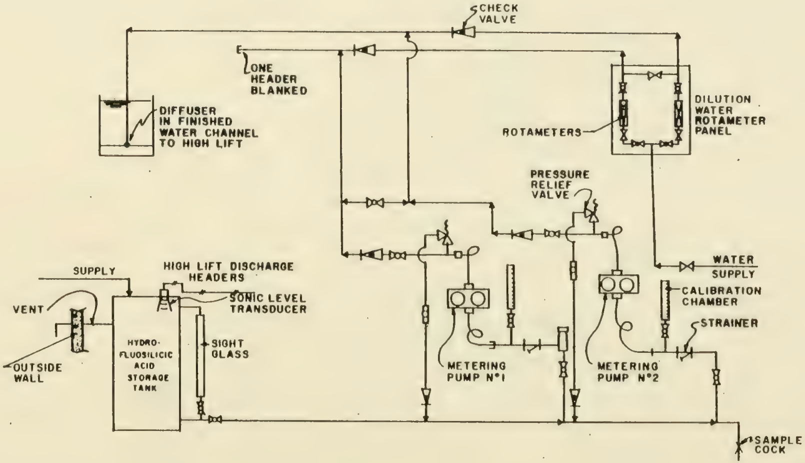
No	Revisions	By	Date

Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

Drawn:
Design:
Checked:

Drawing Title:
BURLINGTON W.P.P.
ALUMINUM SULPHATE
FLOW DIAGRAM

Date:
Scale
Dwg No 8



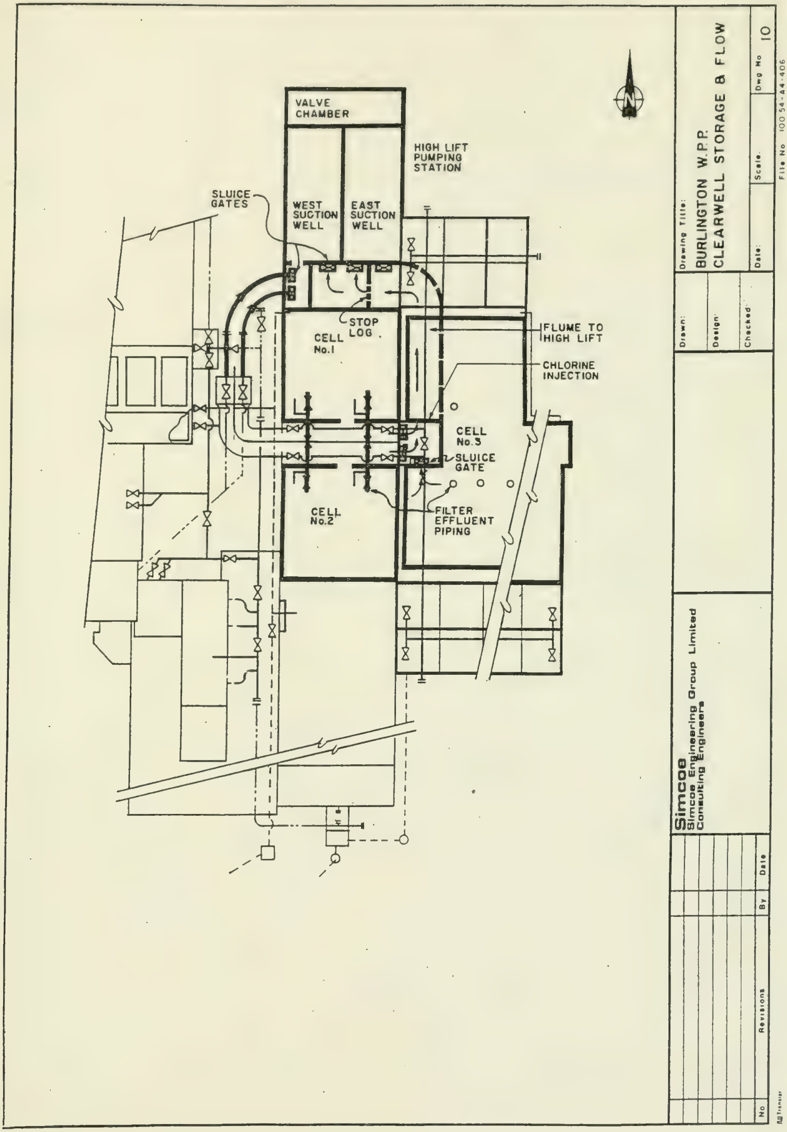
No	Revisions	By	Date

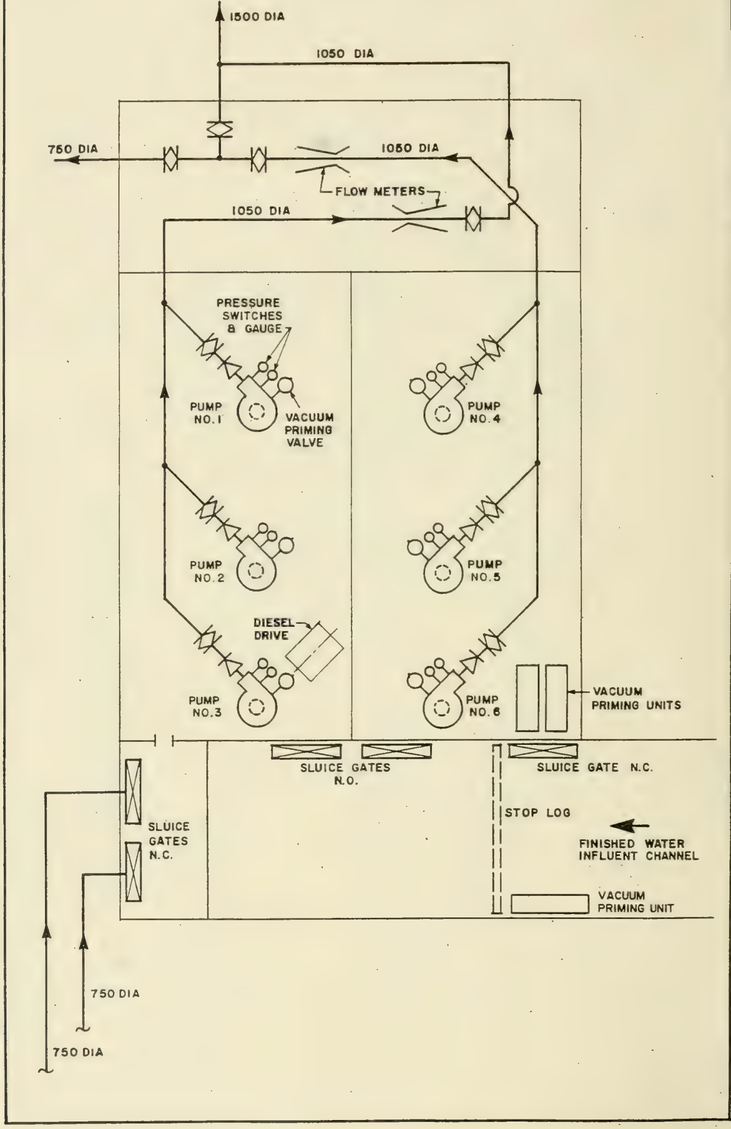
Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

Drawn:
Design:
Checked:

Drawing Title:
BURLINGTON W.P.P.
HYDROFLUOSILICIC ACID
FLOW DIAGRAM

Date:
Scale:
Dwg No 9
File No


VALVE CHAMBER
HIGH LIFT PUMPING STATION
SLUICE GATES
WEST SUCTION WELL
EAST SUCTION WELL
STOP LOG
CELL No.1
FLUME TO HIGH LIFT
CHLORINE INJECTION
CELL No.3
SLUICE GATE
CELL No.2
FILTER EFFLUENT PIPING
N
Drawing Title:
BURLINGTON W.P.P.
CLEARWELL STORAGE & FLOW
Drawn:
Design:
Checked:
Date:
Scale:
Dwg No
10
File No 100 54-A4-406
Simcoe
Simcoe Engineering Group Limited
Consulting Engineers
No
Revisions
By
Date



Drawing Title:
HIGHLIFT PUMPING STATION
SCHEMATIC

Dwg No 11

Scale:

Date:

Drawn:

Design:

Checked:

Simcoe
Simcoe Engineering Group Limited
Consulting Engineers

No.	Revisions	By	Date

SECTION D

PLANT OPERATION

SECTION D

PLANT OPERATION

D.1 GENERAL DESCRIPTION

D.1.1 General

The Burlington Water Purification Plant is a continuously operated, conventional custom-built direct filtration water plant.

The production requirements for the plant range from a low 28.8 ML/d to a high of 113.7 ML/d during the three year study period of 1984-1986. The average day per capita production for the City of Burlington for the study period is approximately 500 Lpcd (110 gpcd) for a population of 116,000.

The operators are in charge of monitoring the plant and distribution system status, sampling, plant operation control, plant inspection and completion of daily log sheets. One of the operators holds the position of Lead Hand. His responsibilities also include handling customer complaints, and administration involved at the plant. The operators duties are supervised by the Plant Foreman, who has overall responsibility for the plant and water system.

D.1.2 Operation

The plant's Supervisory Control and Data Acquisition system operates the plant and controls many of the process components. The plant can also be manually operated at any time.

The Burlington Water Purification Plant is divided into an old and new section. The old section in not in use. The new section which has been described herein is staffed with six operations personnel, seven days a week, 24 hours a day (3 shifts of 8 hours each).

D.2 FLOW CONTROL

D.2.1 Low lift Pumps

There is no control over the operation of the intakes. As mentioned previously, the intakes operate on the principle of gravity flow.

If the treated water flow requirements is increased, the level in the flocculation tanks will drop. Additional flow from the raw water low lift system will be required to maintain the level in the flocculation tanks.

Flow from the low lift station is controlled by modulating valves on the twin raw water headers leading to the flocculation tanks. On the basis of level in both the north and south flocculated water conduits, these valves are modulated to maintain a relatively constant level. When the control valves positions goes outside the 30-70% open range the next/previous duty pump is started/stopped.

The two discharge headers leaving the low lift pumping station are combined immediately outside the station, Downstream of this junction there is an in-line blender for rapid mixing and addition of aluminum sulphate and polymer. There is no control of the in-line blender, as it operates at a constant speed.

Manual control of the low lift pumps is accessible in three locations, CPU, RTU, or LOCAL. CPU manual control is accomplished by input commands directly through the keyboard in order to operate various components of the system. RTU manual control is accessed through the remote terminal unit in the low lift pumping station. In the event of extreme emergency, LOCAL control at each specific piece of equipment may be utilized for operation.

D.2.2 Flocculation

The flocculation system receives water from the low lift pumping station header. The rate of supply is controlled by the level of water in the flocculated water conduit. This level is, in turn, controlled by the rate of flow through the filters.

Each header has a venturi tube with flow transmitter and control valve. Flow through these venturi may be displayed in the main filter building control panel. Flow is automatically controlled as described above. Both raw water flows are summated, indicated and recorded by the control room computer.

Each flocculation tank consists of two banks of three chambers each. Using only one bank ensures that velocity through the system will remain high enough to prevent settling from occurring within the flocculation tanks, and ensures that velocity gradients are maintained as well.

The flocculation chamber influent butterfly valves and the effluent sluice gates are manually operated. Under normal operation they are maintained in an open position and are only closed for maintenance or cleaning of the tanks.

Standard operating procedures are to reduce the number of flocculation tanks in service to maintain approximately 30 minutes retention time in the flocculation tanks, to ensure adequate velocity gradients. The 'temporary' connection between the North and South banks of flocculation tanks restricts flow from these banks to filters on the other side. Thus when flows are low an appropriate combination of filter and flocculation tanks is selected.

D.2.3 Filtration

In normal operation, the influent sluice gate from the flocculated water conduit is opened and the filter drain gate is closed. These two gates are interlocked electrically so that the drain gate can only commence opening if the influent gate is closed, and the influent gate can only commence opening if the drain gate is closed. The filter drain gate and effluent valve are similarly interlocked.

Filtered water passes through a venturi meter equipped with a flow transmitter. The filter rate of flow and filter loss of head signals are displayed at each individual filter control panel and at central control. The filter flow rate can be manually controlled by opening or closing the filter effluent valve from the filter control panel.

The filter system can be operated under local, remote/local, or remote/CPU control. Under local control, each of the filters are controlled individually at the filter location. Under remote/local control, they are operated from the control panel or locally. The remote/CPU control transfers the control of the filters to central control. The operator can operate any of the eight filters from the computer or the filters will operate automatically via a 4-20 mA setpoint entered by the operator and maintained by the computer.

D.2.4. High lift Pumps

There are two types of control for the operation of the high lift system. Under normal (automatic) operation, the high lift pumps start and stop as a function of level in the Washburn Reservoir (when in service), or by the level at the Brant Street Reservoir. If the system is in automatic, pumps will be started and stopped as required to fulfill demand based on predetermined duty selection.

If the system is in manual, pumps must be started by manual control from the keyboard.

In the Auto/Remote control mode, central control will automatically maintain sufficient levels in the reservoirs as well as sufficient pressure in the Zone 1 system.

Manual control is accessible from three locations, CPU, RTU, or LOCAL and is identical in nature to operation of the low lift pumps previously discussed.

D.3 DISINFECTION PRACTICES

D.3.1 Pre-chlorination

Pre-chlorination disinfection is applied in the form of chlorine solution and is added to the water during the pre-treatment stages just after screening using variable feed vacuum gas type chlorinators. The chlorinator used for pre-chlorination has a capacity of 907 kg/d (2000 lb/day). The backup chlorinator has the same capacity. Water samples are obtained from the sample tap usually nine times daily by operations personnel in order to measure the free chlorine residual. The residual is measured using a Wallace and Teirnan titrator. The sample origin is (presently) the effluent line on filter #12. Any of the filters 8-16 could also be used as a sample source. The amount of chlorine feed is determined by the raw water quality and flow. Pre-chlorine dosage was generally higher from June-September during the three year study. The daily average pre-chlorine dosage ranged from 0.25 to 1.78 mg/L over the three year period. The pre-chlorine dosage is based on compound loop control.

D.3.2 Post-Chlorination

Post-chlorination disinfection is applied in the form of chlorine solution and is added to the finished water as it passes out of the clearwell and prior to high lift pumping station suction wells. The chlorinator used for post-chlorination is a variable feed vacuum gas type chlorinator with a capacity of 227 kg/d (500 lb/d) or up to 1.4 mg/L for a plant flow of 165 mL/d (36 migd). The back-up chlorinator has a capacity of 907 kg/d (2000 lb/d) and also serves as the back-up pre-chlorinator.

After post-chlorination, water samples are usually obtained from the high lift discharge header nine times daily in order to manually measure the free chlorine residual.

An automatic chlorine residual analyzer determines whether the post-chlorine dosage is adequate or should be increased or decreased. Both the samples taken manually and the sample analyzed by the post-chlorine residual analyzer are drawn from the high lift discharge header immediately ahead of the high lift venturi chamber (the original fluoride addition point). There were no seasonal variations in post-chlorination dosage during the three year study. The daily average post-chlorination dosage ranged from 0.35 to 1.16 mg/L over the three year study period. The post-chlorine dosage is based on compound loop control. Generally the free chlorine residual leaving the plant is maintained at 0.5 mg/L.

D.4 OPERATION OF SPECIFIC COMPONENTS

D.4.1 Intakes

The use of the intakes is controlled by the sluice gates located between the end of the intakes and the raw water well. Opening or closing a sluice gate is the only means to start or stop the flow. Normally, the 1500 mm intake is used as the primary intake and the 762 mm intake is used as a back up system or during periods of high demand.

A system for backflushing the 1500 mm intake was installed during the 1977-1983 expansion. A 600 mm intake backflush line complete with 600 mm butterfly valve was installed from the 1050 mm raw water header leaving the low lift pumping station, to the raw water influent conduit. During backflushing, the 1800 mm x 2100 mm sluice gate between the raw water conduit and the raw water wet well is closed, the butterfly valve is opened and the low lift pumps are operated. This causes a reverse flow of water through the intake. The backflushing system was installed to rid the intakes of frazil ice, but this condition has not occurred since the system was installed.

There is no chemical addition involved in the operation of the intakes. Pre-chlorination takes place in the raw water well.

D.4.2 Screening

There are two raw water screens located in the low lift pumping station, with provisions for an additional screen.

The travelling (rotating) screen is used as the primary screen and the manual screen is available for standby or emergency use should the travelling screen be out of service for any reason.

The motorized travelling screen is self cleaning. The debris collected by the screen is washed from the screen and hauled to a local landfill site.

The operators are responsible for regular cleaning, inspection and the routine maintenance of the screens through the preventive maintenance program.

D.4.3 Low Lift Pumping

Duty selection of the low lift pumps is done manually by the operator. The rate of flow requirement is dictated by the treatment process rate. As the level in the flocculated water conduit drops, additional flow will be required to maintain this level.

D.4.4 Flash Mixing and Flocculation

An in-line blender is used to inject the aluminum sulphate and polymer into the raw water header prior to the flocculation tanks. The rate of alum and polymer addition is proportional to the rate of flow through the system and is automatically adjusted as flow changes.

Each flocculation tank contains two banks of three chambers each. The operation of the flocculation system is flexible in that banks can be shut down for cleaning, maintenance or inspection during period of low water production requirements.

The controlling factor is the result of jar testing of raw water and experience by the plant operators with regards to measured turbidity levels. These results will indicate whether both banks will be required.

D.4.5 Filters

The filters remove the flocculated material in the water leaving the flocculation tanks. The filtered water passes from the filter clearwell to the suction wells via the finished water conduit where final treatment occurs.

Backwashing of the filters is initiated manually at one of the following events, whichever occurs first:

- headloss in excess of 1.8 - 2.0 metres
- effluent turbidity in excess of 1.0 FTU
- filter run time in excess of 72 hours

The filter run start-up and termination procedures are the same for all filters and are outlined below:

1. Initiate the filter run by opening the influent valve to the filter to allow water onto the filter from the flocculated water conduit.

2. Set the rate of flow desired for the filter. The rate of flow is set to supply the demand on the system plus extra flow to supply variations in demand and for backwash drawdown in the clearwell.

3. The filters fill the clearwell to a point where a clearwell level override sensor overrides a setpoint of the filter controller and takes over controlling the rate of flow of the filters to ensure level control of the clearwell.

4. The filters can be run until they require backwashing.

The filter backwashing procedure is as follows:

i) The filter water is lowered below trough level, but not below the 50% expansion level. Normal level is 400-500 below trough level.

ii) A 5 minute low and 10 minute high backwash cycle is employed after the washwater influent gate is opened. The required pump is selected at the filter building main panel.

iii) The wash rate valve is then adjusted from the filter control panel. The backwash pump automatically stops under the following conditions:

    a) it is turned off by the operator;
    b) the clearwell level is too low;
    c) the waste holding tank is full;
    d) the backwash pump timer has expired.

The waste water is directed to the waste holding tank where is will eventually be directed to the No. 9 Sewage Pumping Station.

When the wastewater is below 15 mg/L suspended solids, it flows directly to the Roseland Creek.

There is a problem in the spring due to run-off and infiltration into the No. 9 pumping station. The demand on the station is constantly high during discharging from the waste holding tank in the plant.

D.4.6 Clearwells and Suction Wells

The clearwells are located directly under the filters, and the suction wells are located under the high lift pumping station. There is no chemical addition directly into the clearwells. The clearwells empty into the high lift suction wells via the finished water influent conduit.

As the high lift pumps are operating, they draw treated water from the suction wells. As the level in the wells decreases, filtered water from the clearwells is drawn into the suction wells.

The filter clearwells can be cleaned, maintained or inspected after the appropriate filters have been locked out of service. Only one clearwell can be serviced at a time. When Well #3 requires service, water flows from Wells #1 and #2 via a pipeline to the west of the clearwells can be isolated for maintenance purposes.

Table D1 summarizes the effect of the drop in volume in the clearwells versus pumping rate.

TABLE D1
BURLINGTON WATER PURIFICATION PLANT CLEARWELL CAPACITY VERSUS PUMPING RATE

PLANT FLOW (m^3/d)	CLEARWELL VOLUME (m^3)	TIME TO EMPTY CLEARWELLS (Hour)
25,000	4,200	4.0
50,000	4,200	2.0
75,000	4,200	1.3
100,000	4,200	1.0
110,000	4,200	0.9

D.4.7 High Lift Pumping

There are six high lift pumps at the Burlington Water Purification Plant. High lift pump 3 is powered by a dual direct drive diesel/electric unit. The diesel drive is used as standby power in emergency situations.

The rate of flow is dictated by the water distribution demand. The pumping units are capable of supplying well over the maximum day demand for the system which is 110,000 m^3/d (24 migd). At times when demand is less than maximum day, water is pumped to Washburn, Brant Street and/or Mount Forest Reservoirs. This provides water to the system at times of demand greater than maximum day.

For each pumping unit, overrides are available which will not permit the pumping unit to be operated under unsatisfactory conditions. Overrides include:

1. Pressure outside a pre-determined limit;
2. Insufficient suction pressure;
3. Insufficient flow.

If any of these conditions occur, the pumps will automatically be shut down.

D.5 CHEMICALS

D.5.1 Pre-Chlorination

The pre-chlorination dosage is based on manually input setpoint control, whereby, the desired chlorine residual is maintained where both flow and raw water quality vary. Chlorine dosage is determined by the raw water quality and anticipated flow. Sufficient chlorine is added to carry a free residual chlorine of about 0.2 - 0.3 mg/L through the plant to the clearwell. Over the three year period, the average pre-chlorine dosage ranged from 0.25 to 1.78 mg/L.

Under normal operation, the chlorine system operates under computer control.

The setpoints from the controller in the residual analyzer are entered by the plant operator and may be altered as conditions require.

Under manual control, the chlorinators are manually adjusted at the chlorinator itself.

D.5.2 Particulate Removal

The appropriate aluminum sulphate dosage is dependant on the raw water turbidity, temperature, alkalinity, pH and other raw water parameters. Only empirical relationships exist for determining the appropriate alum dosage and regular jar testing is required to determine the dosage for the conditions.

The alum metering pumps discharge line connects to the in-line blender (in the low lift area). Dilution water is added to the alum at a rate of approximately 22 L/minute to provide approximately a 50:1 dilution factor. The average alum dosage has ranged from 2.05 to 4.10 mg/L over the study period.

Under normal operation, the aluminum sulphate system operates under computer control whereby the speed of each pump automatically changes in proportion to flow. The stroke of each pump may be altered when the chemical dosage needs to be altered.

The system may be operated manually whereby the speed and/or stroke of each pump can be altered at the pumps.

From experience it has been calculated that the alum to polymer dosage ratio should be approximately 10:1. Typical "low turbidity" operation will require a polymer dosage in the range of 0.2 - 0.5 mg/L. "High turbidity" operation will require dosage in the range of 0.5 - 1.0 mg/L. Over the three year period, the average polymer dosage ranged from 0.22 to 0.65 mg/L.

The liquid polymer (catfloc T) is diluted using a rotameter and is fed through the in-line blender with the alum. The dosage can be automatically controlled by the computer or manually controlled similar to the aluminum sulphate system.

The Region of Halton has expressed interest in bench-scale and plant-scale studies of polyaluminum chloride (PAC) vs alum and activated silica vs polymer to determine whether increased efficiencies or chemical cost savings would result.

D.5.3 Post Chlorination

Post-chlorination application is governed by the chlorine residual analyzer and finished water flow. The analyzer determines whether the post-chlorine dosage is adequate or should be varied. The post-chlorine facilities are controlled to obtain a free chlorine residual of 0.5 mg/L out of the high lift pumping station. The chlorine for post chlorination is diluted using a rotameter for dilution water.

Water quality changes may affect the chlorine demand. Tests are performed in order to monitor the chlorine residual. This testing is done manually nine times per day and continuously by the residual analyzer; subsequent dosage control of the post-chlorinator may be manual or automatic.

D.5.4 Fluoridation

The required fluoride dosage is determined by the operator based on previous residual fluoride levels. The finished water sample line provides fluoridated water to be analyzed by the operator. The fluoride pump stroke positions are adjusted so that the finished water fluoride residual is approximately 1.0 mg/L. The fluoride pump speed is controlled automatically based on flow.

The results of treated water fluoride dosages and residuals are summarized in Table D2 for the three year period 1984-1986.

TABLE D2

BURLINGTON WATER PURIFICATION PLANT
FLUORIDE LEVEL SUMMARY

	1984		1985	1986		
	Dosage	Residual	Dosage	Residual	Dosage	Residual
*Maximum	0.70	1.18	0.61	1.15	0.62	1.12
*Minimum	0.31	0.88	0.29	0.87	0.21	0.90
*Average	0.49	1.00	0.44	1.01	0.40	1.01

** All units in mg/L*

Fluoride levels are measured daily at the plant using a spectrophotomer as well as at the Regional Laboratory on a weekly basis. The maximum desirable concentration for naturally occurring fluoride is 2.4 mg/L, and where fluoridation is practised, the treated water concentration recommend is 1.2 mg/L.

The hydrofluosilicic acid is diluted and the dilution water line is equipped with a rotameter.

D.6 SAMPLING AND DATA COLLECTION

The operations staff at the Burlington Water Purification Plant sample the following water quality parameters: temperature, turbidity, pH, aluminum residual, nitrogen (as ammonia), fluoride residual, and chlorine residual.

The data recorded for the study period of 1984-1986 on raw and treated water is contained in the Appendix.

Table D3 lists the test performed at the plant, the frequency and equipment used.

The sampling and date collection results are either automatically or manually entered onto the process computer and are recorded by the operator onto the daily log sheet.

TABLE D3

BURLINGTON WATER PURIFICATION PLANT IN-PLANT MONITORING

RAW WATER ANALYSIS	FREQUENCY	METHOD
pH	three times per day	HACH spectrophotometer
Ammonia	nine times per day	HACH spectrophotometer
Temperature	nine times per day	Thermometer
Turbidity	nine times per day	HACH turbidimeter (continuous reading)
Pre-Chlorine residual	nine times per day	W & T chlorine titrator

FINISHED WATER ANALYSIS	FREQUENCY	METHOD
pH	three times per day	HACH spectrophotometer
Ammonia	nine times per day	HACH spectrophotometer
Temperature	nine times per day	Thermometer
Turbidity	nine times per day	HACH turbidimeter (continuous reading)
Aluminium residual	three times per day	HACH spectrophotometer
Fluoride residual	nine times per day	HACH spectrophotometer
Post-chlorine residual	nine times per day	W & T chlorine titrator

The data is a good indication of seasonal trends of raw water quality and chemical dosage requirements as well as an overview of plant performance and efficiency. The present lab equipment and supplies need to be upgraded so that sampling by the operators can continue with a reasonable degree of accuracy.

D.7 PROCESS AUTOMATION

The Burlington Water Purification Plant is equipped with a Supervisory Control and Data Acquisition (SCADA) system, which controls and supervises the treatment plant and remote pumping stations and reservoirs within the distribution system. The main console is located in the control room where the operators control and determine the status of various aspects of the plant. The data for the systems points, i.e. point identification, description, status, setpoint and control is summarized and recorded by the computer on a continuous basis. A printout of the system point summary can be acquired at any time by the operator.

The information contained in the computer memory can also provide information to water operations management staff via telephone links to Regional offices.

D.8 DAILY OPERATOR DUTIES

The plant is staffed 24 hours a day, 7 days a week by operators with specific duties. Duties include plant operation and controls, routine plant inspection, process monitoring, sampling and data collecting, analysis and recording.

An operator will check instruments and record the data three times per eight hour shift. A list of the checks and activities follows:

- check and record aluminum sulphate, polymer and fluoride chemical pump speed and stroke, weight of chemical used, dosage, and residual (aluminum and fluoride only);
- check levels in chemical tanks record raw and treated water temperature, pH, ammonia and turbidity levels, not taste or odours if present;
- check pre-chlorination and post-chlorination analyzers, chlorinators and rotameters;

- record pre-chlorine and post-chlorine dosage and residual, and weight of chlorine used;
- record raw water, backwash water and finished water volumes;
- check that the travelling screen is not clogged;
- check low lift pumps, i.e. seal water, oil level, stuffing box etc.;
- calibrate metering pumps if required;
- exercise diesel generator if required;
- check all valve positions;
- check levels in flocculated water conduit, filtered water conduit, clearwells, suction wells, raw water well and waste holding tank;

SECTION E

PLANT PERFORMANCE (PARTICULATE REMOVAL)

SECTION E

PLANT PERFORMANCE (PARTICULATE REMOVAL)

E.1 TURBIDITY REMOVAL

E.1.1 General

The treatment process is direct filtration. Aluminum sulphate is used as the prime coagulant at the Burlington Water Purification Plant to de-stabilize any colloidal suspensions present in the raw water and to agglomerate the suspended particles to the appropriate size for the flocculation and filtration processes. A polyelectrolyte (polymer) is used as a coagulant aid to increase the rate and degree of flocculation. The operation of the particulate removal process is described in Section C - Process Components.

E.2 PLANT PERFORMANCE (TURBIDITY)

The Burlington Water Purification Plant records, and the Ontario Ministry of the Environment laboratory analysis reports, as summarized in Tables 2.0 and 5.3 in the Appendix, indicate that the raw water turbidity fluctuates, but under normal conditions the average level is less than 5 FTU. At times of higher turbidity, the Burlington Water Purification Plant has been able to effectively reduce turbidity levels to within Ontario Drinking Water Objectives. On four occasions in the three year study period the treated water turbidity level has exceeded 1.0 FTU, the highest recorded daily average valve being 1.20 FTU. The treated water turbidity ranged from 0.08 to 1.20 FTU over the study period. When turbidity levels are high, jar-testing is conducted on-site to determine aluminum sulphate dosages. A visual inspection of the floc in the flocculation tanks and the effluent from the filters is a good indication of whether the performance and dosage is satisfactory. The use of a streaming current monitor may aid in optimizing dosage. From the information contained in Table 2.0, the average aluminum sulphate dosage for the three years from 1984 to 1986 ranges between 2.05 mg/L and 4.10 mg/L based on monthly averages.

Generally speaking, the aluminum sulphate to polymer dosage is at a 10:1 ratio. The actual polymer dosage required for effective treatment can only be determined by evaluation of the process performance at any one time. Polymer dosage is determined on a trial and error basis based on raw water quality, visual inspection and experience. From the information contained in Table 2.0, the polymer dosage for the three years from 1984 to 1986 ranges between 0.22 mg/L and 0.65 mg/L based on monthly averages. The polymer injection location and mixing efficiency could be studied in order to increase efficiency.

In order to fully evaluate the particulate removal efficiency of the plant, complete daily records need to be properly maintained for all the process components, namely:

1. Raw water turbidity;
2. Finished water turbidity;
3. Chemical dosages and residuals;
4. Raw and finished water flows;
5. Backwash flows.

Presently, all of these parameters are measured and recorded on a continuous basis by the SCADA system and central computer at the Burlington Water Purification Plant and on daily log sheets by the operators. As a result the efficiency of the flocculation and filtration processes can be assessed and the overall treatment process can be evaluated.

Table E1 is a particulate removal profile of the the plant from February 13, 1984 to February 17, 1984 and is an excerpt from Tabe 2.1 in the Appendix.

TABLE E1
BURLINGTON WATER PURIFICATION PLANT PARTICULATE REMOVAL PROFILE

DATE	TURBIDITY (FTU) RAW	TURBIDITY (FTU) TREATED	COAGULANT DOSAGE (mg/L)	COAGULANT AID DOSAGE (mg/L)	PH TREATED	TEMP (C)
Feb 13/84	4.6	0.26	2.32	0.23	7.4	5
Feb 14/84	10.0	1.20	2.77	0.34	7.5	5
Feb 15/84	19.0	0.37	2.97	0.33	7.5	5
Feb 16/84	38.0	1.17	4.53	0.82	7.4	4
Feb 17/84	40.0	0.65	6.02	0.84	7.5	4

The treated water turbidity on February 14, 1984 and February 16, 1984 was 1.20 FTU and 1.17 FTU respectively, both of which exceed the Ontario Drinking Water Objectives.

From February 13, 1984 to February 14, 1984 the raw water turbidity increased from 4.6 FTU to 10.0 FTU, an increase of 117%. The aluminum sulphate and polymer dosages were only increased slightly, 19% and 48% respectively. The treated water had high turbidity levels.

However from February 14, 1984 to February 15, 1984, the raw water turbidity increased from 10.0 FTU to 19.0 FTU an increase of 90%, the alum and polymer dosages remained consistent both days, yet the treated water turbidity decreased from 1.20 on February 14,1984 to only 0.37 on February 15, 1984. The response on February 15, 1984 cannot be explained without a particle size count being performed.

Over the three day period it can be concluded that the response to the increased turbidity was slow. It may be that the increased turbidity was a result of increased smaller particles that would not easily agglomerate or filter out. The first day of increased chemical dosages had little effect, but after a second day, the treated water turbidity was lowered - possibly due to increased partical size and charge, hence the coagulation process was improved.

However in the three day period from February 15, 1984 to February 17, 1984, the response was different. Two days of increased alum and polymer dosage resulted in a treated water turbidity of 0.65 FTU.

Table E2 indicates the monthly average raw and treated water turbidity over the study period at the Burlington Water Purification Plant.

Based on the monthly average results, it can be concluded that the plant consistently reduces turbidity levels to below 0.6 FTU with high removal efficiencies.

An indication of proper coagulant dosage over the entire study period is the residual aluminum concentration in the treated water. The recorded data for treated water residual aluminum exists from February 1985 - December 1986, and is found in Tables 2.0 and 2.1 in the Appendix. Based on monthly averages, the residual aluminum range is from 0.01 mg/L to 0.05 mg/L. These good results stem from the use of a coagulant aid and hence a reduction in aluminum sulphate required for coagulation. A guideline to avoid problems

TABLE E2

BURLINGTON WATER PURIFICATION PLANT AVERAGE TURBIDITY RAW AND TREATED WATER

	1986		1985		1984	
	RAW	TREATED	RAW	TREATED	RAW	TREATED
JAN.	1.26	0.18	2.51	0.16	4.13	0.25
FEB.	3.28	0.24	2.16	0.20	14.13	0.35
MAR.	2.36	0.22	3.27	0.19	7.44	0.39
APR.	1.35	0.29	2.65	0.22	3.99	0.31
MAY	0.95	0.36	1.10	0.33	2.41	0.29
JUNE	0.89	0.31	1.07	0.35	2.22	0.37
JULY	1.27	0.35	1.08	0.54	2.49	0.31
AUG.	1.21	0.23	2.22	0.48	3.20	0.56
SEPT.	1.41	0.29	3.64	0.28	3.78	0.33
OCT.	1.46	0.24	1.32	0.20	3.27	0.34
NOV.	1.21	0.23	3.15	0.29	3.28	0.25
DEC.	4.07	0.16	1.01	0.19	5.70	0.21
AVERAGE	1.73	0.26	2.10	0.29	4.67	0.33

associated with aluminum is to maintain a residual below 0.10 mg/L as A1 in the treated water.

E.3 TREATABILITY TESTING

Due to unusually low raw water turbidity readings, normally less than 4 FTU, jar testing is not performed on a regular basis at the Burlington Water Purification Plant but turbidity is measured nine times per day by the operators.

When jar testing is performed due to high turbidity levels, the procedures are in accordance with the industry accepted practice - Standard Methods. These results are used to determine optimum aluminum sulphate and polymer dosages.

E.4 OPTIMUM REMOVAL STRATEGIES

Although, the Burlington Water Purification Plant has been able to effectively and consistently reduce turbidity levels to within the 1.0 FTU limit of the Ontario Drinking Water Objectives, it is desirable to strive to reduce trubidity levels to the lowest levels possible.

In order to optimize the existing particulate removal process, and to be able to evaluate the efficiency of the flocculation and filtration processes, turbidimeter measurements and recordings should be made immediately after the flocculation process. Presently there is a sample line from the flocculated water conduit, through the chemical building and leading to the pre-chlorine residual analyser, (but not used for chlorine analysis). It should be investigated as to whether this line, is or could be, branched to the existing turbidity monitoring panel in the low lift pumping station.

A filter media study was recommended during this study and has been implemented to determine effective size, depths and contours. The head loss through the filters could be improved and possible filter run times, volumes and rates could be optimized. Problems have been experienced in the past with filter media loss as a result of backwash. An examination of individual filters will determine the present amounts of anthracite and sand within each filter. This investigation will help determine what effect the backwash rates, volumes etc., have had on the newer filters since they were first installed approximately five years ago.

E.5 PERFORMANCE (COLOUR)

The results of the raw and treated water colour levels over the three year study period from 1984 - 1986, are summarized in Table E3.

TABLE E3

BURLINGTON WATER PURIFICATION PLANT COLOUR LEVEL SUMMARY

	1984		1985		1986	
	RAW	TREATED	RAW	TREATED	RAW	TREATED
*Maximum	8.0	3.5	4.75	2.0	6.0	1.5
*Minimum	3.0	1.5	2.0	<0.5	<0.5	<0.5
*Average	5.5	2.5	2.94	1.0	2.9	0.7

** All units in TCU*

The treated water sample results indicate effective colour level reduction through the process components. Colour analysis is not conducted on site but grab samples are noted for clarity on a regular daily basis.

Because of low raw water colour levels and the success of the plant in producing low treated water colour levels, there is no need for on site colour testing. The tests performed weekly by the Regional Laboratory are sufficient to indicate colour levels.

E.6 CONCLUSIONS

Based on the raw and finished water turbidity levels recorded over the past three years, as summarized in Tables 2.0 and 2.1 in the Appendix, the plant produced treated water with turbidity consistently below 1.0 FTU with the exception of four days in the 3 year period or 0.4% of the time. The colour, fluoride residual and aluminum residual are well within the Ontario Drinking Water Objectives.

As noted in Section E.4, a filter media study was recommeded and has been implemented to determine depths, effective sizes, and uniformity coefficients of the filter media as well as the extent of media intermixing. Review of the media should be an ongoing process at the plant.

SECTION F

PLANT PERFORMANCE (DISINFECTION)

SECTION F

PLANT PERFORMANCE (DISINFECTION)

F.1 GENERAL

Chlorine gas is used as the source of chlorine for the processes of pre-chlorination and post-chlorination at the Burlington Water Purification Plant. Chlorine is used in the water treatment process for the disinfection of the water supply. The operation of the pre-chlorination and post-chlorination processes are described in Section C - Process Components.

F.2 LEVEL OF DISINFECTION

The pre-chlorination chlorine demand is greater during the summer months for 1984-1986 since the warmer water temperatures promote algae and bacterial growth. Table 6.0 summarizes three years of bacteriological testing conducted by the Regional Health Department. During this period, 140 raw water samples and 140 treated water samples were analyzed for total coliform, fecal coliform and fecal strep. The MPN of total coliform in the raw water are normally less than 100 (only 15 cases where the MPN of total coliform was greater than 100, and 1 case where it was greater than 5,000). In all cases total coliform was absent in the treated water. The MPN of fecal coliform in the raw water are normally less than 10 (only 17 cases where the MPN of fecal coliform was greater than 10, and 3 cases where it was greater than 500). In all cases fecal coliform was absent in the treated water.

The fecal strep levels of the raw water are normally less than 1 (only 26 cases where fecal strep was greater than 2, and 3 cases where it was greater than 50). In all cases, fecal strep was absent in the treated water.

The plant's chlorination/disinfection process system is able to effectively reduce the bacteriological levels to well within the Ontario Drinking Water Objective of 5 MPN for total coliform and 0 MPN for fecal coliform.

From the information contained in Tables 3.0 and 3.1 in the Appendix, the Burlington Water Purification Plant has been able to maintain a desirable free chlorine residual in the treated water leaving the plant as well as effectively disinfect the water supply. The average monthly free chlorine residual of the treated water for the three years from 1984 to 1986 varied between 0.30 mg/L and 0.65 mg/L after the post-chlorination process and averaged 0.52 mg/L over the three year period. Table F1 summarizes the yearly average pre-chlorination and post-chlorination demands, dosages and residuals at the plant for the three year study period.

TABLE F1

BURLINGTON WATER PURIFICATION PLANT DISINFECTION

	PRE-CHLORINATION			POST-CHLORINATION		
	DEMAND	DOSAGE	RESIDUAL	DEMAND	DOSAGE	RESIDUAL
1986	0.88	1.07	0.190	0.08	0.44	0.56
1985	0.58	0.76	0.21	0.40	0.72	0.54
1984	N.A.	0.86	N.A.	N.A.	0.56	0.46

**All units in mg/L*

It is apparent that from 1985 to 1986 the pre-chlorination demand has increased, possibly a reflection of decreased water quality, and hence the dosage has had to increase to maintain the pre-chlorination residual.

It is important to note, however, that the post-chlorination demand has decreased substantially, hence lower post-chlorination dosages are required to maintain the treated water chlorine residual.

The Ministry of the Environment analyzes for chlorinated by-products (total trihalomethanes including chloroform) on a weekly basis at the Burlington Water Purification Plant. There have been recent concerns with trihalomethanes since they are considered to be carcinogenic. The Ontario Drinking Water Objectives have set the maximum acceptable concentration of total trihalomethanes at 350 μg/L. The chlorinated by-products in the treated water at the Burlington Plant are well within these guidelines. The average monthly total trihalomethane concentration of the treated water for the three year period from 1984 to 1986 varied between <3 μg/L and 38.2 μg/L after the post-chlorination process.

F.3 OPTIMUM REMOVAL STRATEGIES

Although the concentrations of total trihalomethanes for the period 1984 to 1986 are well below the Ontario Drinking Water Objectives, it is important to reduce these chlorinated by-products to as minimal an amount as possible. This would involve optimizing the chemical dosages and residual chlorine levels.

The weekly testing for chlorinated by-products by the MOE is adequate and it should be ensured that this practice continues.

Due to the results of the disinfection processes at the plant over the three year study period, as summarized in Tables 3.0 to 3.2, it would appear that no major modifications are necessary for the pre-chlorination and post-chlorination systems. It should be pointed out that due to the design of the plant and the location of the post-chlorine application point, there is very little chlorine contact time. In the past some bacteriological problems developed in the distribution system and these were corrected by re-chlorination from booster pumping stations in the system.

The possibility of considering other feasible alternatives, such as ozonation in order to reduce trihalomethanes, should be considered.

F.4 CONCLUSIONS

It is evident that the raw water is being properly disinfected; the treated water leaving the plant has a desireable chlorine residual and the concentrations of trihalomethanes are well below the Ontario Drinking Water Objective Guidelines. The chlorination processes are efficient and monitoring and sampling are done on a regular basis with good records kept.

The lack of post-chlorination contact time has been raised as a concern and this could be addressed by changing the point of chlorine application so that chlorine is added to the clear wells. Another option would be to provide additional capacity/detention time in the high lift pump suction wells. This may not be a problem since post-chlorination is only a process for increasing the residual from a low value to the desired value of ± 0.5 mg/L, i.e. disinfection has already been finished by the time the water reaches the High Lift Pumping Station well. The chlorination contact time is really from when pre-chlorine is added approximately 2 hours before the water reaches any consumer.

SECTION G

IMMEDIATE AND SHORT TERM MODIFICATIONS

SECTION G

IMMEDIATE AND SHORT TERM MODIFICATIONS

G.1 GENERAL

In this section of the report, we have examined the necessary immediate and short term process modifications to optimize the disinfection and particulate removal efficiencies of the plant.

The immediate modifications include all works required to be implemented as soon as possible, whereas the short term phase includes all works required within the next two years. The following recommended modifications or studies have been categorized into either the immediate or short term phase. It is important to note that at the time of publication of this document, certain recommended modifications and studies may have been initiated and/or completed.

G.2 IMMEDIATE MODIFICATIONS

G.2.1 Filter Media Study

A filter media study should be implemented to determine filtration efficiency. The filter media study would involve media sampling to determine depths, effective sizes and contours of the media. The sampling would also determine if there is any sand and anthracite intermixing and how this problem could be rectified if it exists. There is evidence of an oily scum residue on the filters and media sampling could determine whether media replacement is required. The implementation of additional agitation into the backwash process should also be investigated.

G.2.2 Backwash Evaluation

An evaluation of the efficiency of the backwash should be conducted. Investigation will include studying the feasibility of air scour and air/water backwash sequence and timing.

G.2.3 Coagulant Study

It is recommended that both bench-scale and plant-scale modelling and studies of poly-aluminum chloride versus aluminum sulphate as the primary coagulant and polymer versus other coagulant aids such as activated silica be conducted to determine which is best suited for this plant.

G.2.4 Polymer Study

The effectiveness of the existing coagulant aid system (the use of polymer) should be studied. The study should include an investigation of the polymer injection location as well as the mixing efficiency of the polymer and alum. The possibility of mixing the polymer and alum prior to injection should be studied as well.

G.2.5 Plant Flow Audit

A complete plant flow audit is recommended to ensure that the measuring components in the plant are performing within accurate ranges. Operations personnel at the Burlington Water Purification Plant have had considerable problems in the past in obtaining an accurate correlation of low lift and high lift flows throughout the plant.

G.2.6 Streaming Current Monitor

The addition of a streaming current monitor (SCM) located following the coagulant addition point, could assist in determining the optimum dosages of aluminum sulphate for coagulation. Dosages would be automatically or manually adjusted and the SCM would respond to changes in raw water turbidities and flow rates. A study to determine its effectiveness and advantages should be implemented.

G.3 SHORT TERM MODIFICATIONS

G.3.1 Chemical Tanks

During the water plant optimization study plant inspection, it was noted that the hydrofluosilicic acid tanks and the aluminum sulphate tanks are bermed, but if a leak did occur, the berms will not contain the entire contents of the tanks. These tanks are PVC lined wood stave tanks and the wood stave tank is liquid tight. There are weep holes near the bottom of the wood stave tanks to provide an indication of any leakage in the interior liner. These should be monitored regularly.

G.3.2 Replacement of Mercury Switches

The Region designed and installed a plant flood override system since the last plant expansion. The system contains approximately 15 mercury float switches at various locations throughout the plant. It is recommended that all mercury switches located in the clearwells and filters be replaced, possibly by probes. It is not advisable to have mercury filled float switches in the potable water supply.

G.3.3 Laboratory Equipment

There is a lack of proper laboratory equipment at the Burlington Water Purification Plant. New glassware such as beakers, flasks, test tubes, etc. are required. Presently there is a limited supply of such equipment so certain testing cannot be conducted as often as desired. There is also a need for upgrading the jar testing equipment and the Hach spectrophotometer.

G.3.4 Upgrading of Filter Effluent Turbidity Monitoring

The filter effluent turbidity monitoring needs to be upgraded. Presently each filter is monitored for five minutes, every forty minutes. This is not sufficient to allow optimization of particulate removal. An in-line continuous monitoring system for each filter is recommended.

G.3.5 Taste and Odour Control Study

A complaint recording format was first established in 1984. In 1985, 33 quality complaints were received. In 1986, 56 complaints were received of which 48 were taste and odour. It is recommended that a study be implemented to evaluate the use of powdered activated carbon and/or granular activated carbon at the plant for taste and odour control.

G.3.6 Study of Waste Water System

Operations personnel have had problems with the existing wastewater system. The problems occur in spring when run-off and infiltration at the No. 9 Sewage Pumping Station are high and thus discharging of the holding tank at the water plant puts a large demand on the pumping station. When this happens there is a possibility that backwash water with greater than 15 mg/L suspended solids will be returned to the lake. It is therefore recommended that this system be reviewed to determine if the infiltration problem at the Sewage Pumping Station can be corrected.

SECTION H

LONG TERM MODIFICATIONS

SECTION H

LONG TERM MODIFICATIONS

H.1 GENERAL

In this section of the report, we have examined the long term process modifications to optimize the disinfection and particulate removal efficiencies of the plant.

The long term phase includes all works required to be implemented within the next five years.

H.2 LONG TERM MODIFICATIONS

H.2.1 Investigation of Plant Hydraulics

An overall investigation of the plant hydraulics should be conducted after the implementation of the short term modifications as described in Section G. Presently, during special maintenance procedures the plant experiences problems with a flocculated water conduit restriction between the South flocculation tanks and the North filters and vice versa. As a result, it has been difficult to supply sufficient quantities of water to certain filters during these times. A study to examine the flocculation tank hydraulics and retention times is in order. This study would determine if the tanks are working adequately and which portion of the tanks should be utilized for different levels of flow through the plant.

H.2.2 Installation of Additional Flocculation Tanks and Filters

Additional flocculation and filtration capacity will be required in order to increase the flow through the plant, and improve operations efficiency. As part of the 1977-1983 expansion of the plant, provisions were made for two additional filters and flocculation tanks to be built on the north side of the plant.

H.2.3 Post Chlorination Contact Time

The chlorination system should be reviewed to determine if it is necessary to provide increased post contact time. This could involve the relocation of the application point to the clearwells or provision of additional pump suction well capacity.

H.2.4 Emergency Contingency Plan

An emergency contingency plan should be drafted for the Burlington Water Purification Plant. This plan would provide operators with more information with which they can react to in an emergency situation. The development of a software package to simulate plant problems for operator training and to optimize the operators input for process control is required. The emergency contingency plan would also incorporate an emergency spills plan.

APPENDICES

TABLE 1.0

RAW AND TREATED WATER FLOWS (ML/d)
1984, 1985, 1986

TABLE 1.0: FLOWS (ML/d)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1986			1985			1984			1983		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	R	60.4	37.4	48.697	N/A	N/A	N/A	61.608	44.916	55.114			
	T	57.9	35.4	46.423	58.596	44.284	51.918	58.830	41.136	51.619			
FEB	R	63.6	42.7	54.186	67.716	45.544	57.516	67.083	47.520	55.361			
	T	59.2	42.0	51.775	61.904	45.544	53.332	58.578	47.322	50.645			
MAR	R	64.7	34.9	52.874	69.391	45.544	55.234	71.784	47.124	55.553			
	T	59.2	33.4	50.784	59.179	44.284	51.221	62.736	45.540	50.847			
APR	R	64.83	47.5	57.463	74.472	48.312	59.393	67.344	46.926	55.704			
	T	64.33	43.5	55.063	70.062	45.028	54.114	59.784	46.926	51.240			
MAY	R	97.6	53.948	69.030	109.494	57.778	73.982	73.218	49.46	58.855			
	T	91.6	53.018	65.675	104.494	49.508	67.893	65.028	47.718	53.757			
JUN	R	83.0	56.3	68.526	91.862	46.2	68.085	95.184	54.718	73.317			
	T	78.0	50.2	64.659	86.082	39.8	62.293	87.352	54.172	66.107			
JUL	R	123.0	54.5	81.67	113.0	46.8	73.826	121.904	46.926	83.65			
	T	111.0	52.58	76.638	106.0	43.1	68.352	113.714	46.926	74.972			
AUG	R	85.5	47.3	67.301	119.0	39.8	74.319	109.698	61.016	82.453			
	T	79.5	47.3	63.236	115.0	39.8	70.948	109.698	50.936	73.125			
SEP	R	80.0	54.7	64.695	69.0	45.0	54.847	77.664	49.578	61.666			
	T	80.0	48.7	60.912	63.5	45.0	51.813	69.474	45.37	55.618			
OCT	R	75.2	51.0	60.274	58.5	36.0	50.761	65.716	46.08	58.058			
	T	67.625	46.8	56.758	58.5	36.0	48.068	64.014	45.88	53.29			
NOV	R	63.9	42.2	56.0	54.3	36.0	47.063	67.93	45.058	56.292			
	T	61.5	41.2	52.748	52.1	36.0	44.223	58.862	42.978	51.962			
DEC	R	64.7	43.5	55.9	49.5	33.3	43.2	72.298	47.062	57.624			
	T	58.2	39.7	52.465	46.8	28.8	40.781	65.998	44.542	52.507			

NOTE: N/A: data not available
R: raw water
T: treated water

TABLE 1.1

TREATED WATER
DAILY FLOWS (ML/d) 1984, 1985, 1986

Page 1 of 2

TABLE 1.1: DAILY FLOWS (ML/d) 1984

MOE WPOS PROTOCOL   BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON										55.42		
TUE					47.718					53.81		
WED		52.908			52.912			94.638		54.012		
THU		58.578	56.652		53.128			57.57		55.892	55.96	
FRI		52.092	50.784		53.688	54.948		63.312		53.584	53.806	
SAT		48.006	48.153		51.918	54.718		61.398	50.952	55.176	52.134	47.69
SUN	41.136	48.116	48.708	48.906	49.46	54.172	68.968	69.426	50.472	46.08	45.208	48.704
MON	52.576	50.946	45.540	50.466	49.658	60.104	75.846	64.004	52.53	46.728	52.02	53.544
TUE	51.030	52.626	55.464	52.92	57.758	67.61	90.276	86.092	55.628	57.474	54.348	60.06
WED	48.714	48.128	48.996	51.68	48.312	68.854	79.95	82.174	60.528	52.668	48.638	53.004
THU	56.928	52.380	54.264	50.0	60.549	60.266	65.682	62.138	55.858	64.014	54.724	52.39
FRI	55.986	47.916	47.916	51.612	49.26	75.018	54.162	70.336	58.438	51.576	48.612	51.63
SAT	47.322	47.520	47.622	47.718	59.94	66.432	46.926	61.808	63.73	54.26	53.852	48.51
SUN	47.916	51.510	49.410	49.608	47.718	73.62	50.574	65.014	54.948	46.278	47.524	49.35
MON	52.212	54.138	50.700	51.636	52.148	85.104	65.188	72.93	69.474	53.526	50.634	51.274
TUE	52.788	49.476	50.160	54.492	52.968	86.594	52.232	74.848	50.172	54.948	54.948	52.126
WED	53.364	51.324	54.054	50.772	54.466	87.352	52.90	83.544	54.04	54.264	54.264	60.012
THU	52.032	50.250	47.124	52.774	54.268	69.866	64.972	81.874	50.458	54.752	51.578	54.722
FRI	58.830	54.294	53.640	54.37	50.242	65.50	63.696	86.434	63.872	54.036	50.948	54.038
SAT	47.124	47.718	47.718	48.114	63.004	66.66	89.968	65.46	52.236	54.72	51.142	54.038
SUN	48.468	47.520	47.718	46.926	48.514	48.242	64.89	50.936	50.32	45.88	45.058	47.516

Page 2 of 2

TABLE 1.1: (Cont'd) 1984

BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	54.948	52.608	51.018	53.544	50.616	68.718	85.77	72.108	52.02	59.926	58.862	65.998
TUE	54,000	51.420	48.114	48.708	56.700	62.59	66.948	69.924	60.432	53.396	51.842	54.028
WED	51.048	49.650	50.454	52.42	50.548	66.154	52.52	66.38	62.504	62.232	51.06	54.952
THU	55.764	51.954	55.404	50.146	65.028	73.608	72.266	84.344	68.298	50.496	53.808	55.512
FRI	54.792	54.138	47.334	51.682	60.96	67.316	68.710	76.968	54.952	55.95	51.084	54.268
SAT	46.926	47.322	50.900	48.312	50.69	61.778	77.014	92.972	52.550	50.178	54.192	50.232
SUN	50.766	47,718	47.520	47.714	55.822	54.768	83.80	94.888	45.37	50.292	42.978	55.424
MON	54.036	53.202	51.072	47.124	53.55	54.720	90.378	109.698	58.852	52.872	55.406	49.686
TUE	54.264	47.520	53.340	53.064	53.22	62.232	92.148	74.678	55.172	55.636	55.18	51.73
WED	54.594	47.718	52.344	56.074	48.51	60.844	90.782	63.234	57.012	50.106	57.674	46.052
THU	47.544		50.454	54.222	54.492	62.856	83.088	61.956	54.036		49.78	49.694
FRI	52.746		50.934	52.440		72.60	71.492	58.836	51.642		53.578	55.316
SAT	47.562		62.736	50.166		69.954	95.012		48.948			44.542
SUN	47.520			49.812			93.758		55.628			47.520
MON	52.746			59.784			100.512					54.160
TUE	54.492						113.714					
MAX	58.830	58.578	62.736	59.784	65.028	87.352	113.714	109.698	69.474	64.014	58.862	65.998
MIN	41.136	47.322	45.540	46.926	47.718	54.172	46.926	50.936	45.37	45.88	42.978	44.542
AVG	51.619	50.645	50.847	51.240	53.757	66.107	74.972	73.125	55.618	53.29	51.962	52.507

TABLE 1.1: DAILY FLOWS (ML/d) 1985

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON				51.894			73.5					
TUE	44.284			52.392			65.3			53.3		
WED	50.040			54.268	59.122		75.4			50.3		
THU	52.880			51.966	63.11		106.0	82.1		42.0		
FRI	51.782	54.596	52.518	49.55	68.55		82.1	96.4		55.5	49.7	
SAT	48.230	47.320	47.419	48.312	59.852	58.190	43.9	97.5		47.3	37.5	
SUN	47.124	47.716	52.264	46.53	50.424	68.412	45.0	100.0	45.0	42.8	37.5	37.9
MON	50.004	61.674	54.72	53.428	59.396	86.082	54.8	86.3	46.5	51.0	49.5	44.5
TUE	55.176	50.750	51.648	53.81	63.172	59.3	51.4	87.4	54.4	51.4	49.5	43.1
WED	51.680	55.172	51.252	50.166	60.168	50.608	56.6	85.1	58.2	58.5	47.3	45.0
THU	47.922	47.522	59.179	52.32	63.336	74.30	64.5	115.0	52.0	53.6	46.5	43.5
FRI	55.862	61.904	49.91	53.072	66.848	63.8	56.6	108.0	56.5	42.4	52.1	45.0
SAT	50.864	50.14	53.092	50.232	92.268	83.3	54.0	100.0	51.8	47.3	36.8	37.1
SUN	50.602	47.518	45.102	47.916	63.330	71.3	44.8	93.0	51.4	36.0	36.0	36.8
MON	53.086	54.918	49.596	58.328	79.164	77.6	43.1	89.0	54.4	47.6	49.5	46.8
TUE	52.4	49.456	54.492	58.872	81.692	57.4	48.0	91.9	53.6	47.6	51.8	36.3
WED	53.926	52.284	46.140	51.975	64.908	59.6	63.0	102.0	56.6	46.9	52.1	43.5
THU	52.188	52.584	52.548	57.978	70.038	47.6	66.4	53.6	54.8	53.6	47.6	45.0
FRI	51.612	54.72	54.474	53.234	65.648	60.0	63.4	61.1	51.8	47.6	44.6	42.0
SAT	53.886	47.916	46.224	52.53	62.606	64.1	57.0	57.8	49.5	36.8	36.0	36.3
SUN	47.324	49.782	48.276	52.332	67.452	43.5	57.0	56.6	51.4	47.6	37.5	36.0

TABLE 1.1: (Cont'd) 1985 BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	51.864	54.718	52.002	60.948	75.906	57.4	75.4	60.2	53.6	47.6	49.5	42.7
TUE	58.596	53.970	53.528	54.264	64.838	58.1	77.6	45.4	53.6	49.5	45.0	43.1
WED	55.176	51.672	56.476	57.586	73.126	54.0	87.4	52.9	44.6	42.4	45.0	43.5
THU	52.143	59.526	51.652	61.338	83.273	48.0	94.9	49.5	63.1	49.5	43.5	43.1
FRI	55.858	56.336	51.420	58.066	95.512	55.5	88.1	53.3	63.5	51.0	45.0	39.8
SAT	46.814	45.544	49.776	56.816	104.494	46.1	96.0	46.1	54.9	49.5	36.4	40.5
SUN	51.611	52.440	44.284	45.028	49.508	39.8	91.1	47.6	52.5	39.0	42.0	34.5
MON	49.2	51.300	52.288	70.062	54.95	56.6	94.1	53.6	49.5	50.6	47.6	44.2
TUE	56.092	50.268	53.742	62.20	59.316	46.1	88.9	45.8	50.6	54.0	45.0	45.0
WED	54.496	60.888	49.476		60.558	72.6	53.6	48.8	52.9	42.4	41.3	40.1
THU	56.742	50.802	55.722		66.086	76.7		39.8	49.1	55.5	44.6	28.8
FRI			52.890		56.018	79.1		48.0	40.9		39.4	40.5
SAT			47.720			76.1		45.6	41.6		40.9	34.1
SUN			47.520			77.6			53.3			43.1
MON									42.8			43.4
TUE												39.0
MAX	58.596	61.904	59.179	70.062	104.494	86.082	106.0	115.0	63.5	58.5	52.1	46.8
MIN	44.284	45.544	44.284	45.028	49.508	39.8	43.1	39.8	45.0	36.0	36.0	28.8
AVG	51.918	53.332	51.221	54.114	67.893	62.293	68.352	70.948	51.813	48.068	44.223	40.781

TABLE 1.1: DAILY FLOWS (ML/d) 1986

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON									57.8			56.2
TUE				43.5			69.8		80.0			52.2
WED	44.3			56.67			66.81		71.8	67.625		58.2
THU	39.4			54.4	60.85		102.0		53.2	57.6		55.6
FRI	37.5			54.8	58.073		85.5	72.3	64.8	52.7		54.6
SAT	39.3	44.2	52.0	50.084	58.15		92.3	73.9	60.0	55.7	52.5	54.6
SUN	36.0	46.2	47.5	49.728	53.948	65.88	111.0	52.8	58.2	47.8	52.5	47.3
MON	40.0	45.8	54.3	56.6	63.314	52.296	87.44	57.8	70.28	67.4	56.3	50.1
TUE	49.5	42.0	51.9	58.0	65.919	65.13	83.66	79.5	73.26	63.4	61.5	56.9
WED	44.6	48.3	56.8	58.4	63.25	69.681	93.728	71.3	58.8	66.2	50.4	56.1
THU	43.5	54.0	48.0	57.65	71.14	69.43	85.6	62.1	54.3	60.66	51.24	56.2
FRI	44.2	50.6	49.4	58.4	65.426	56.1	73.8	64.4	56.7	62.6	53.9	55.7
SAT	36.0	42.7	47.6	46.9	91.6	56.5	52.58	63.3	53.2	50.5	47.5	48.1
SUN	39.7	48.0	48.2	54.1	91.447	57.6	66.7	49.4	52.4	47.0	52.1	49.1
MON	45.0	59.0	48.7	55.2	72.776	74.9	87.1	65.3	60.2	49.6	52.8	55.0
TUE	45.0	58.7	58.8	52.4	75.1	70.5	73.2	65.3	61.53	56.365	56.1	49.5
WED	41.6	58.5	59.3	58.4	60.58	50.2	75.7	65.3	62.7	55.9	56.0	56.2
THU	44.6	50.8	48.7	53.81	64.39	62.770	79.8	64.9	68.9	61.1	60.9	56.1
FRI	51.2	55.5	44.9	53.342	57.3	66.376	66.2	70.44	58.4	54.1	60.3	56.0
SAT	45.7	49.9	49.0	47.92	65.58	53.8	64.655	50.8	53.5	51.8	50.6	55.8
SUN	43.7	44.9	46.8	56.6	60.595	63.3	54.0	47.3	53.9	53.5	50.5	47.9

TABLE 1.1: (Cont'd) 1986 BURLINGTON WATER PURIFICATION PLANT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MON	52.5	50.7	54.8	53.15	53.018	51.8	64.6	71.5	65.24	57.0	54.0	56.6
TUE	56.9	48.9	59.2	56.8	60.0	67.5	76.56	70.68	56.14	58.7	55.8	56.0
WED	51.1	50.0	56.2	55.2	56.18	57.4	77.12	73.3	66.7	54.4	54.0	56.1
THU	55.9	52.3	48.8	54.2	58.6	72.6	80.1	63.6	60.4	65.3	46.9	43.1
FRI	56.3	45.0	50.2	56.4	57.354	78.0	75.3	69.5	55.5	56.1	46.9	39.7
SAT	35.4	55.7	49.4	59.8	55.093	70.4	56.4	51.2	61.6	50.0	46.7	48.2
SUN	52.3	43.0	33.4	60.52	55.056	69.215	58.0	57.5	48.7	46.8	41.2	43.5
MON	54.7	59.2	49.7	54.33	72.336	71.2	87.2	64.4	61.7	58.5	54.8	54.4
TUE	50.8	54.8	53.9	56.4	60.062	59.4	75.04	65.3	67.5	56.7	57.0	51.6
WED	55.2	58.8	51.0	58.2	67.317	68.8	79.2	66.3		56.0	52.7	49.8
THU	49.3	53.6	55.6		83.1	73.5	74.7	62.6		58.2	53.8	
FRI	57.9	58.6	48.8		86.261	67.5		62.3		61.24	55.0	
SAT			48.6		72.11	63.4		57.8			53.9	
SUN			47.3			64.5		48.2			44.6	
MON			55.5			70.1						
TUE												
MAX	57.9	59.2	59.2	64.33	91.6	78.0	111.0	79.5	80.0	67.625	61.5	58.2
MIN	35.4	42.0	33.4	43.5	53.018	50.2	52.58	49.4	48.7	46.8	41.2	39.7
AVG	46.423	51.060	50.784	55.063	65.675	64.659	76.638	63.2	60.912	56.758	52.748	52.465

TABLE 2.0

PARTICULATE REMOVAL SUMMARY 1984-1986

TABLE 2.0: PARTICULATE REMOVAL SUMMARY

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Turbidity (FTU)		R	3.77	0.65	1.26	13.0	0.54	2.51	15.0	1.8	4.13			
			T	0.27	0.13	0.18	0.32	0.10	0.16	0.34	0.20	0.25			
	Prime Coagulant	(mg/L)		4.18	2.78	3.28	2.87	2.07	2.47	3.54	1.49	2.18			
	Coagulant Aid	(mg/L)		0.33	0.19	0.25	0.57	0.22	0.36	0.26	0.14	0.22			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.02	---	---	---	---	---	---			
	pH		R	8.1	7.9	8.01	---	---	---	---	---	---			
			T	7.6	7.1	7.47	7.7	7.4	7.6	7.7	7.2	7.5			
	Temperature	(°C)		5	3	4	8	4	5	6	3	4			
FEB	Turbidity (FTU)		R	10.1	1.05	3.28	14.1	0.60	2.16	62.0	2.0	14.13			
			T	0.38	0.12	0.24	0.55	0.13	0.20	1.20	0.20	0.35			
	Prime Coagulant	(mg/L)		3.40	2.33	2.78	2.43	1.99	2.14	6.58	2.02	3.08			
	Coagulant Aid	(mg/L)		0.30	0.14	0.22	0.51	0.35	0.44	0.84	0.21	0.38			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.02	0.02	0.01	0.02	---	---	---			
	pH		R	8.3	7.97	8.03	8.0	7.8	8.0	---	---	---			
			T	7.6	7.4	7.5	7.6	7.4	7.5	7.8	7.3	7.5			
	Temperature	(°C)		3	2	2	8	5	6	6	4	4			
MAR	Turbidity (FTU)		R	19.6	0.62	2.36	14.59	0.48	3.27	14.0	1.8	7.44			
			T	1.03	0.13	0.22	0.33	0.11	0.19	0.84	0.16	0.39			
	Prime Coagulant	(mg/L)		14.35	2.18	3.93	3.25	2.19	2.81	3.54	1.54	2.29			
	Coagulant Aid	(mg/L)		3.46	0.14	0.65	0.68	0.28	0.40	0.47	0.21	0.31			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.02	0.03	0.01	0.01	---	---	---			
	pH		R	8.2	7.9	8.06	8.1	7.8	7.9	---	---	---			
			T	7.6	7.27	7.47	7.6	7.3	7.5	7.8	7.2	7.5			
	Temperature	(°C)		5	2	3	9	8	9	6	2	4			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Turbidity (FTU)		R	5.5	0.73	1.35	15.9	0.83	2.65	9.3	1.9	3.99			
			T	0.43	0.18	0.29	0.43	0.13	0.22	0.61	0.13	0.31			
	Prime Coagulant	(mg/L)		6.10	2.25	3.16	3.59	2.42	2.95	2.50	1.67	2.05			
	Coagulant Aid	(mg/L)		0.79	0.21	0.37	0.70	0.29	0.43	0.35	0.23	0.28			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.02	0.02	0.01	0.02	---	---	---			
	pH		R	8.3	7.97	8.09	8.2	7.8	8.0	---	---	---			
			T	7.7	7.43	7.56	7.8	7.4	7.6	8.1	7.2	7.5			
	Temperature	(°C)		8	5	6	12	9	10	7	4	6			
MAY	Turbidity (FTU)		R	1.3	0.69	0.95	1.38	0.79	1.10	7.5	1.5	2.41			
			T	0.49	0.21	0.36	0.40	0.23	0.33	0.50	0.17	0.29			
	Prime Coagulant	(mg/L)		5.37	2.07	2.69	3.32	2.32	2.96	2.49	1.56	2.17			
	Coagulant Aid	(mg/L)		0.64	0.13	0.34	0.55	0.19	0.32	0.34	0.22	0.27			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.03	0.01	0.02	0.03	0.02	0.02	---	---	---			
	pH		R	8.4	8.0	8.12	8.2	8.0	8.1	---	---	---			
			T	7.8	7.53	7.67	7.9	7.4	7.7	8.0	7.2	7.5			
	Temperature	(°C)		12	6	9	17	9	12	9	6	7			
JUN	Turbidity (FTU)		R	1.74	0.66	0.89	2.99	0.74	1.07	3.3	1.2	2.22			
			T	0.45	0.17	0.31	0.59	0.25	0.35	0.56	0.19	0.37			
	Prime Coagulant	(mg/L)		6.06	2.08	3.01	4.13	2.66	3.43	2.82	1.25	2.28			
	Coagulant Aid	(mg/L)		0.57	0.19	0.36	0.48	0.13	0.29	0.38	0.21	0.29			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.08	0.01	0.03	0.04	0.01	0.02	---	---	---			
	pH		R	8.4	7.9	8.21	8.2	7.9	8.0	---	---	---			
			T	7.8	7.5	7.65	7.8	7.4	7.6	7.9	7.1	7.4			
	Temperature	(°C)		15	9	12	19	11	15	16	8	11			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Turbidity (FTU)		R	2.12	0.81	1.27	1.65	0.61	1.08	3.2	1.8	2.49			
			T	0.60	0.21	0.35	0.67	0.34	0.54	0.55	0.16	0.31			
	Prime Coagulant	(mg/L)		5.52	2.00	3.71	4.57	2.41	3.34	2.98	2.02	2.30			
	Coagulant Aid	(mg/L)		0.49	0.21	0.35	0.31	0.14	0.23	0.37	0.24	0.29			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.06	0.02	0.04	0.04	0.01	0.03	---	---	---			
	pH		R	8.2	7.87	8.06	8.2	7.9	8.0	---	---	---			
			T	7.77	7.4	7.56	7.7	7.4	7.5	7.7	7.1	7.4			
	Temperature	(°C)		22	9	16	21	9	13	14	8	10			
AUG	Turbidity (FTU)		R	2.20	0.83	1.21	3.26	1.30	2.22	5.4	1.8	3.2			
			T	0.38	0.16	0.23	0.68	0.13	0.48	1.10	0.27	0.56			
	Prime Coagulant	(mg/L)		6.94	2.96	4.10	4.46	2.32	3.34	3.59	2.83	3.15			
	Coagulant Aid	(mg/L)		0.51	0.28	0.38	0.53	0.13	0.27	0.57	0.39	0.47			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.06	0.02	0.03	0.07	0.03	0.05	---	---	---			
	pH		R	8.2	8.0	8.07	8.2	7.8	8.1	---	---	---			
			T	7.77	7.37	7.49	7.7	7.3	7.5	7.6	7.2	7.4			
	Temperature	(°C)		22	13	18	23	19	21	24	13	19			
SEP	Turbidity (FTU)		R	4.31	0.8	1.41	6.40	2.13	3.64	7.6	1.3	3.78			
			T	0.51	0.16	0.29	0.58	0.19	0.28	0.68	0.18	0.33			
	Prime Coagulant	(mg/L)		4.76	2.26	2.74	4.80	2.79	3.64	3.91	1.98	2.57			
	Coagulant Aid	(mg/L)		0.47	0.22	0.30	0.88	0.27	0.49	0.53	0.29	0.42			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.05	0.02	0.03	0.10	0.02	0.05	---	---	---			
	pH		R	8.4	7.9	8.1	8.4	7.9	8.1	---	---	---			
			T	7.63	7.4	7.5	7.6	7.2	7.5	7.9	7.3	7.4			
	Temperature	(°C)		20	9	15	23	20	21	18	9	16			

TABLE 2.0: PARTICULATE REMOVAL SUMMARY (cont'd)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

				1986			1985			1984			1983		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Turbidity (FTU)		R	6.0	0.76	1.46	2.96	0.37	1.32	5.6	1.8	3.27			
			T	0.47	0.17	0.24	0.44	0.12	0.20	0.55	0.21	0.34			
	Prime Coagulant	(mg/L)		4.69	2.02	2.96	3.44	2.63	3.08	3.09	2.04	2.57			
	Coagulant Aid	(mg/L)		0.51	0.19	0.32	0.57	0.21	0.28	0.51	0.24	0.40			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.05	0.01	0.02	0.04	0.01	0.02	---	---	---			
	pH		R	8.1	7.9	8.0	8.3	7.9	8.0	---	---	---			
			T	7.6	7.33	7.46	7.7	7.3	7.5	7.9	7.3	7.5			
	Temperature	(°C)		17	9	14	18	11	14	15	7	12			
NOV	Turbidity (FTU)		R	6.2	0.65	1.21	9.93	1.29	3.15	6.3	1.5	3.28			
			T	0.38	0.13	0.23	0.62	0.16	0.29	0.61	0.12	0.25			
	Prime Coagulant	(mg/L)		4.39	2.01	2.63	6.36	2.81	3.90	3.85	1.16	2.27			
	Coagulant Aid	(mg/L)		0.37	0.17	0.27	0.67	0.21	0.36	0.41	0.22	0.32			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.02	0.03	0.01	0.02	---	---	---			
	pH		R	8.1	7.7	8.0	8.2	7.7	8.0	---	---	---			
			T	7.6	7.3	7.48	7.6	7.2	7.4	7.7	7.3	7.5			
	Temperature	(°C)		12	7	9	15	12	14	13	7	10			
DEC	Turbidity (FTU)		R	16.5	1.14	4.07	2.20	0.68	1.01	22.0	1.2	5.70			
			T	0.39	0.08	0.16	0.27	0.14	0.19	0.36	0.14	0.21			
	Prime Coagulant	(mg/L)		6.31	2.12	3.20	3.76	3.22	3.52	2.64	1.51	2.10			
	Coagulant Aid	(mg/L)		0.52	0.26	0.32	0.34	0.24	0.28	0.77	0.22	0.40			
	Filter Aid	(mg/L)		---	---	---	---	---	---	---	---	---			
	Metal Res. Al/Fe	(mg/L)	R	---	---	---	---	---	---	---	---	---			
			T	0.02	0.01	0.01	0.02	0.01	0.02	---	---	---			
	pH		R	8.1	7.9	7.99	8.1	7.9	8.0	---	---	---			
			T	7.6	7.4	7.48	7.7	7.4	7.5	7.7	7.3	7.6			
	Temperature	(°C)		7	5	6	13	4	8	10	7	7			

TABLE 2.1

PARTICULATE REMOVAL PROFILE (JANUARY, MAY, JULY, OCTOBER)/1984

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1984) BURLINGTON WATER PURIFICATION PLANT

MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	(°C)
1	4.5			.22	1.69	.14					7.5	3
2	4.4			.29	3.54	.22					7.6	4
3	3.8			.34	2.08	.22					7.6	6
4	3.6			.34	1.49	.16					7.7	4
5	4.0			.25	1.97	.19					7.5	5
6	3.8			.25	1.89	.19					7.2	5
7	5.6			.21	2.14	.21					7.4	6
8	4.0			.26	2.11	.21					7.5	6
9	5.7			.25	2.26	.23					7.7	6
10	6.4			.23	2.25	.24					7.6	4
11	5.6			.30	2.25	.25					7.6	4
12	10.0			.29	2.23	.23					7.6	4
13	15.0			.32	2.05	.22					7.6	3
14	5.6			.30	2.01	.21					7.6	5
15	3.8			.27	2.22	.23					7.7	4

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1984) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	(^{o}C)
16	3.0			.24	2.32	.24					7.6	4
17	2.8			.23	2.03	.21					7.4	4
18	2.1			.26	2.02	.21					7.5	4
19	2.7			.22	2.31	.25					7.4	5
20	2.5			.25	2.35	.26					7.4	4
21	2.1			.24	2.23	.25					7.4	4
22	2.0			.22	2.28	.25					7.4	3
23	2.2			.22	2.38	.26					7.4	3
24	2.4			.20	2.50	.24					7.4	4
25	2.3			.22	2.15	.22					7.3	4
26	2.0			.20	2.32	.24					7.4	4
27	1.8			.21	2.02	.21					7.5	4
28	1.9			.20	2.06	.22					7.5	4
29	1.9			.25	2.13	.23					7.5	4
30	2.4			.27	2.07	.21					7.4	5
31	4.0			.33	2.24	.23					7.5	4

* Data not recorded

Page 1 of 2

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1984) BURLINGTON WATER PURIFICATION PLANT

MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	
1	2.4			.23	1.86	.26					7.5	6
2	2.6			.24	1.56	.22					7.5	6
3	2.0			.20	2.21	.29					7.5	6
4	2.1			.19	1.85	.24					7.5	6
5	2.5			.36	1.68	.28					7.4	6
6	2.9			.36	2.04	.26					7.5	7
7	2.8			.30	2.49	.32					7.6	9
8	2.5			.38	2.01	.26					7.6	8
9	7.4			.35	2.28	.25					8.0	7
10	2.0			.31	2.14	.28					8.0	7
11	2.0			.28	2.18	.28					7.7	7
12	2.2			.27	2.22	.28					7.5	7
13	1.9			.26	2.15	.28					7.5	7
14	2.5			.25	2.33	.29					7.5	7
15	2.5			.31	2.20	.29					7.6	7

* Data not recorded.

TABLE 2.1: **PARTICULATE REMOVAL PROFILE (MAY/1984) (cont'd)** BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	
16	2.1			.25	2.16	.28					7.6	7
17	2.2			.29	2.33	.30					7.5	7
18	2.2			.25	1.96	.26					7.6	7
19	2.3			.35	2.17	.29					7.8	8
20	2.2			.25	2.15	.34					7.4	8
21	1.5			.34	2.37	.34					7.5	8
22	1.5			.39	2.46	.29					7.6	8
23	2.6			.39	2.40	.25					7.6	8
24	1.6			.28	2.34	.24					7.4	8
25	1.6			.23	2.13	.23					7.6	8
26	1.9			.50	2.27	.24					7.4	8
27	1.7			.17	2.40	.24					7.5	9
28	2.0			.28	2.35	.25					7.4	8
29	7.5			.27	2.24	.25					7.4	8
30	4.4			.28	2.06	.23					7.2	8
31	2.1			.24	2.19	.24					7.5	9

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1984) BURLINGTON WATER PURIFICATION PLANT

MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	(^{o}C)
1	1.0			.24	2.34	.28					7.3	14
2	2.2			.38	2.42	.29					7.6	11
3	3.2			.32	2.23	.28					7.4	9
4	2.4			.30	2.38	.25					7.6	9
5	2.6			.25	2.29	.28					7.4	8
6	2.4			.38	2.02	.28					7.4	10
7	2.1			.37	2.04	.24					7.4	8
8	2.0			.21	2.15	.27					7.4	8
9	2.0			.31	2.61	.32					7.4	9
10	2.6			.27	2.28	.28					7.4	9
11	2.2			.25	2.56	.33					7.4	10
12	2.2			.25	2.32	.31					7.4	10
13	2.2			.25	2.48	.33					7.3	11
14	3.0			.28	2.35	.29					7.4	11
15	2.5			.30	2.34	.28					7.4	13

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1984) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	(°C)
16	2.9			.23	2.27	.27					7.3	9
17	2.5			.31	2.44	.30					7.4	9
18	3.0			.30	2.37	.30					7.4	11
19	2.5			.16	2.05	.32					7.4	10
20	2.5			.31	2.25	.36					7.6	9
21	2.6			.25	2.12	.26					7.1	10
22	2.6			.37	2.23	.29					7.2	12
23	2.8			.46	2.15	.26					7.6	10
24	3.0			.26	2.18	.27					7.3	9
25	3.1			.20	2.14	.27					7.5	9
26	2.6			.32	2.32	.28					7.5	10
27	2.2			.29	2.32	.26					7.4	11
28	2.5			.35	2.27	.26					7.3	11
29	2.9			.51	2.18	.27					7.6	10
30	2.2			.55	2.25	.31					7.7	14
31	2.0			.53	2.98	.37					7.5	14

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1984) BURLINGTON WATER PURIFICATION PLANT
MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	
1	2.3			.34	2.35	.42					7.4	15
2	2.3			.46	2.61	.48					7.3	15
3	1.9			.21	2.75	.51					4.4	9
4	2.0			.27	2.52	.46					7.3	8
5	2.2			.28	2.55	.48					7.4	7
6	2.5			.28	2.50	.48					7.3	9
7	1.9			.30	2.15	.44					7.5	9
8	1.9			.34	2.35	.44					7.5	11
9	2.3			.37	2.18	.41					7.5	12
10	1.8			.28	2.54	.37					7.4	12
11	2.1			.34	2.31	.31					7.8	10
12	1.8			.26	2.40	.31					7.5	10
13	2.1			.43	2.33	.31					7.5	11
14	1.8			.42	2.04	.27					7.4	11
15	2.0			.45	2.41	.39					7.6	12

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1984) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.*	Raw*	Treat.	(°C)
16	5.0			.55	2.71	.48					7.6	13
17	5.6			.41	2.60	.49					7.6	13
18	5.5			.41	2.60	.44					7.6	13
19	3.1			.47	2.64	.49					7.9	13
20	3.2			.38	2.73	.50					7.7	13
21	4.0			.28	2.51	.43					7.7	14
22	4.3			.21	2.63	.46					7.4	13
23	4.4			.21	2.82	.47					7.5	13
24	4.7			.33	2.70	.40					7.7	13
25	4.2			.33	3.05	.40					7.7	13
26	4.3			.32	2.63	.33					7.6	13
27	4.4			.30	2.70	.34					7.5	13
28	4.6			.30	2.71	.34					7.6	13
29	4.3			.28	3.09	.30					7.5	13
30	4.1			.32	2.94	.24					7.5	13
31	4.7			.32	2.69	.32					7.5	13

* Data not recorded.

TABLE 2.1

PARTICULATE REMOVAL PROFILE (JANUARY, MAY, JULY, OCTOBER)/1985

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1985) BURLINGTON WATER PURIFICATION PLANT
MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.**	Raw**	Treat.	(^{o}C)
1	8.85			0.32	2.40	0.25					7.6	8
2	4.30			0.30	2.41	0.26					7.5	6
3	2.75			0.15	2.45	0.28					7.6	6
4	1.80			0.15	2.70	0.23					7.6	5
5	1.50			0.13	2.57	0.22					7.5	6
6	2.50			0.10	2.48	0.23					7.5	6
7	13.0			0.21	2.32	0.27					7.6	6
8	12.40			0.24	2.73	0.57					7.6	6
9	2.60			0.15	2.32	0.51					7.7	6
10	2.30			0.10	2.47	0.51					7.5	6
11	4.05			0.12	2.46	0.55					7.5	6
12	2.10			0.13	2.26	0.55					7.4	5
13	2.10			0.17	2.35	0.38					7.5	5
14	1.75			0.20	2.52	0.40					7.5	5
15	1.45			0.14	2.30	0.37					7.4	5

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1985) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^oC)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.**	Raw**	Treat.	
16	1.38			0.15	2.37	0.35					7.6	5
17	1.28			0.32	2.11	0.37					7.5	5
18	1.00			0.13	2.39	0.40					7.7	5
19	1.78			0.12	2.32	0.41					7.7	4
20	0.78			0.12	2.07	0.40					7.6	4
21	0.87			0.13	2.27	0.38					7.5	4
22	0.71			0.10	2.58	0.39					7.6	4
23	0.75			0.12	2.47	0.46					7.6	4
24	0.70			0.13	2.24	0.45					7.6	4
25	0.63			0.12	2.87	0.42					7.5	4
26	0.58			0.11	2.52	0.27					7.6	5
27	0.58			0.12	2.87	0.30					7.6	4
28	0.54			0.14	2.76	0.24					7.7	4
29	0.55			0.15	2.84	0.34					7.6	4
30	0.68			0.15	2.67	0.27					7.5	4
31	1.63			0.18	2.54	0.26					7.5	5

* Data not recorded.
** Data not available.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1985) BURLINGTON WATER PURIFICATION PLANT

MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	(^{o}C)
1	1.28			0.25	2.83	0.55			0.02	8.0	7.6	9
2	1.14			0.23	2.82	0.42			0.02	8.0	7.6	10
3	1.06			0.30	2.71	0.38			0.02	8.1	7.6	11
4	1.16			0.29	2.95	0.44			0.02	8.0	7.6	11
5	1.08			0.26	2.72	0.34			0.02	8.0	7.5	10
6	1.11			0.32	2.63	0.34			0.02	8.1	7.6	10
7	1.03			0.34	2.73	0.20			0.02	8.1	7.6	10
8	1.17			0.35	2.32	0.20			0.02	8.1	7.6	10
9	0.97			0.35	2.76	0.24			0.02	8.0	7.6	10
10	1.07			0.29	3.02	0.23			0.03	8.1	7.6	10
11	1.33			0.35	2.74	0.21			0.02	8.1	7.6	11
12	1.11			0.34	3.12	0.25			0.02	8.1	7.7	11
13	1.21			0.31	3.24	0.19			0.03	8.0	7.7	12
14	1.33			0.29	2.95	0.37			0.02	8.1	7.4	11
15	1.02			0.33	3.08	0.30			0.03	8.1	7.7	12

* Data not recorded.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1985) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	(°C)
16	1.10			0.40	3.32	0.37			0.02	8.1	7.7	13
17	0.95			0.29	3.23	0.36			0.02	8.1	7.7	13
18	0.99			0.36	3.28	0.35			0.02	8.2	7.8	13
19	0.94			0.31	3.15	0.43			0.02	8.1	7.8	13
20	1.38			0.39	3.05	0.36			0.03	8.1	7.9	14
21	1.26			0.24	3.01	0.29			0.03	8.1	7.7	12
22	1.05			0.29	2.80	0.29			0.02	8.1	7.6	13
23	1.00			0.38	2.95	0.22			0.02	8.1	7.7	13
24	1.09			0.39	3.03	0.26			0.02	8.1	7.7	14
25	1.26			0.37	3.01	0.37			0.02	8.0	7.6	14
26	0.93			0.34	3.23	0.38			0.02	8.1	7.6	15
27	0.79			0.40	3.02	0.28			0.02	8.2	7.8	16
28	1.32			0.37	2.87	0.33			0.02	8.1	7.7	16
29	1.07			0.38	3.28	0.28			0.02	8.2	7.7	17
30	**			**	**	**			**	**	**	**
31	0.79			0.40	3.04	0.25			0.02	8.1	7.6	17

* Data not recorded.
** Data not available.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1985) BURLINGTON WATER PURIFICATION PLANT
MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	
1	0.85			0.52	3.48	0.22			0.03	8.0	7.7	21
2	0.89			0.66	3.70	0.29			0.04	8.2	7.7	21
3	1.02			0.67	3.37	0.20			0.03	8.1	7.7	19
4	0.84			0.61	3.11	0.26			0.03	8.1	7.6	18
5	0.83			0.51	3.60	0.27			0.02	8.1	7.6	16
6	0.67			0.52	3.66	0.31			0.02	8.0	7.5	12
7	0.61			0.52	4.57	0.28			0.01	8.0	7.5	9
8	0.75			**	3.40	0.24			0.02	8.0	7.4	10
9	0.84			**	3.68	0.24			0.03	8.0	7.4	13
10	0.72			**	3.55	0.25			0.03	7.9	7.4	11
11	0.85			**	3.32	0.23			0.02	8.0	7.4	11
12	0.96			**	3.43	0.26			0.03	8.0	7.5	12
13	1.03			**	3.43	0.17			0.03	8.1	7.6	12
14	1.00			**	3.30	0.18			0.03	8.0	7.5	12
15	1.17			**	3.18	0.14			0.02	8.0	7.5	10

* Data not recorded.
** Data not available.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JULY/1985) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.**	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	(°C)
16	1.19			0.34	3.25	0.22			0.01	8.0	7.5	10
17	1.23				2.90	0.19			0.02	8.0	7.6	12
18	1.11				2.65	0.20			0.02	8.2	7.5	13
19	1.03				2.50	0.22			0.03	8.2	7.7	12
20	1.11				2.99	0.21			0.02	8.0	7.5	12
21	1.12				3.10	0.26			0.02	7.9	7.4	12
22	1.06				2.41	0.24			0.02	7.9	7.4	11
23	1.23				3.11	0.25			0.02	8.0	7.5	10
24	1.26				3.60	0.24			0.03	8.0	7.5	12
25	1.29				3.33	0.23			0.03	7.9	7.4	13
26	1.37				3.06	0.24			0.03	7.9	7.5	11
27	1.38				3.26	0.25			0.03	8.0	7.6	11
28	1.42				4.00	0.21			0.03	8.0	7.6	13
29	1.34				3.45	0.24			0.04	8.0	7.5	13
30	1.61				3.49	0.24			0.04	8.1	7.5	14
31	1.65				3.64	0.29			0.04	8.1	7.5	16

* Data not recorded.
** Data not available.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1985) BURLINGTON WATER PURIFICATION PLANT
MOE WPOS PROTOCOL

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	
1	2.16			0.25	2.71	0.25			0.02	8.0	7.4	18
2	2.20			0.20	3.22	0.26			0.02	8.0	7.4	12
3	2.90			0.22	3.34	0.26			0.02	8.3	7.4	15
4	2.96			0.44	2.79	0.21			0.04	8.2	7.6	18
5	2.90			0.30	3.26	0.41			0.02	8.0	7.6	15
6	2.60			0.16	3.10	0.25			0.02	7.9	7.4	12
7	2.10			0.14	3.21	0.25			0.02	7.9	7.4	11
8	2.10			0.14	3.05	0.22			0.02	8.0	7.4	11
9	2.40			0.15	2.80	0.20			0.02	8.0	7.4	11
10	1.70			0.16	2.96	0.26			0.02	7.9	7.3	11
11	0.96			0.14	3.37	0.26			0.02	7.9	7.4	11
12	1.00			0.14	3.14	0.22			0.03	8.0	7.4	12
13	2.10			0.12	3.31	0.57			0.03	7.9	7.5	12
14	0.80			0.17	3.02	0.23			0.01	7.9	7.3	11
15	1.00			0.14	3.44	0.24			0.01	8.0	7.5	11

* Data not recorded.
** Data not available.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1985) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L*	Raw*	Treat.	Raw	Treat.	
16	1.10			0.15	3.32	0.23			0.01	8.0	7.5	11
17	0.49			0.12	2.63	0.23			0.01	8.0	7.4	12
18	0.37			0.15	3.11	0.30			0.02	8.1	7.5	13
19	0.44			0.20	3.03	0.35			0.02	8.0	7.5	15
20	0.55			0.19	3.11	0.31			0.02	8.1	7.7	15
21	0.83			0.24	3.02	0.29			0.01	8.1	7.5	15
22	0.81			0.32	3.22	0.27			0.02	8.2	7.6	15
23	0.70			0.30	3.37	0.32			0.04	8.2	7.5	15
24	0.98			0.26	2.93	0.28			0.04	8.1	7.6	15
25	0.66			0.18	2.89	0.31			0.03	8.1	7.6	16
26	0.71			0.20	3.04	0.31			0.03	8.0	7.5	16
27	0.56			0.15	3.15	0.33			0.04	8.0	7.5	14
28	0.63			0.17	2.97	0.25			0.02	8.1	7.4	15
29	0.66			0.17	3.10	0.31			**	**	7.4	15
30	0.58			0.20	3.07	0.30			0.03	8.1	7.5	15
31	0.98			0.23	2.82	0.29			0.02	8.1	7.5	15

* Data not recorded.
** Data not available.

TABLE 2.1

PARTICULATE REMOVAL PROFILE (JANUARY, MAY, JULY, OCTOBER)/1986

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
1	0.78	--	--	0.17	3.41	0.23	--	--	0.02	8.0	7.4	4
2	0.78	--	--	0.17	4.18	0.31	--	--	0.02	8.0	7.5	4
3	1.4	--	--	0.20	3.67	0.29	--	--	0.02	8.0	7.5	4
4	1.8	--	--	0.21	4.03	0.33	--	--	0.02	8.0	7.5	4
5	2.7	--	--	0.23	3.67	0.33	--	--	0.02	8.0	7.4	4
6	2.1	--	--	0.18	3.35	0.29	--	--	0.02	8.0	7.5	3
7	1.8	--	--	0.22	3.37	0.26	--	--	0.02	8.0	7.6	4
8	1.08	--	--	0.19	3.31	0.25	--	--	0.02	8.03	7.47	3
9	1.03	--	--	0.16	3.34	0.23	--	--	0.02	8.03	7.53	4
10	0.86	--	--	0.16	3.72	0.27	--	--	0.02	8.03	7.53	4
11	0.85	--	--	0.13	3.58	0.25	--	--	0.02	8.03	7.5	4
12	0.74	--	--	0.15	3.69	0.21	--	--	0.02	8.0	7.5	4
13	0.82	--	--	0.15	3.37	0.24	--	--	0.02	8.07	7.47	5
14	0.70	--	--	0.15	3.54	0.24	--	--	0.02	8.07	7.5	4
15	0.66	--	--	0.17	3.49	0.28	--	--	0.02	8.03	7.47	3

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JAN./1986) (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
16	0.66	--	--	0.17	3.39	0.26	--	--	0.01	8.03	7.5	3
17	0.65	--	--	0.16	3.19	0.23	--	--	0.01	8.0	7.5	4
18	0.66	--	--	0.15	2.96	0.23	--	--	0.02	8.0	7.43	4
19	0.73	--	--	0.17	2.92	0.23	--	--	0.02	8.0	7.5	4
20	1.2	--	--	0.23	2.97	0.22	--	--	0.01	7.95	7.4	4
21	1.2	--	--	0.27	2.79	0.19	--	--	0.01	7.9	7.1	4
22	0.77	--	--	0.17	2.91	0.24	--	--	0.01	8.0	7.4	5
23	0.68	--	--	0.14	2.79	0.20	--	--	0.01	8.0	7.4	4
24	0.84	--	--	0.15	2.78	0.19	--	--	0.01	8.0	7.5	4
25	3.77	--	--	0.25	3.31	0.25	--	--	0.02	8.0	7.4	4
26	3.09	--	--	0.21	2.85	0.20	--	--	0.02	8.1	7.5	4
27	2.10	--	--	0.18	2.99	0.25	--	--	0.02	8.0	7.5	4
28	1.6	--	--	0.20	2.97	0.22	--	--	0.02	8.0	7.5	3
29	1.2	--	--	0.16	2.80	0.21	--	--	0.02	8.0	7.5	3
30	1.1	--	--	0.17	3.26	0.24	--	--	0.02	8.0	7.5	3
31	0.79	--	--	0.17	2.96	0.23	--	--	0.02	8.0	7.5	3

* Note: Facilities not available to record settled water and filtered water turbidity levels.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
1	1.15	--	--	0.35	3.28	0.56	--	--	0.02	8.1	7.6	7
2	0.98	--	--	0.29	2.53	0.48	--	--	0.02	8.0	7.6	7
3	0.89	--	--	0.27	2.48	0.51	--	--	0.02	8.0	7.6	6
4	0.80	--	--	0.21	2.37	0.32	--	--	0.02	8.1	7.6	6
5	0.75	--	--	0.28	2.30	0.17	--	--	0.01	8.1	7.7	6
6	0.96	--	--	0.31	2.18	0.28	--	--	0.02	8.1	7.6	6
7	0.92	--	--	0.30	2.24	0.25	--	--	0.02	8.03	7.6	6
8	0.84	--	--	0.30	2.07	0.21	--	--	0.02	8.03	7.7	6
9	0.81	--	--	0.38	2.54	0.39	--	--	0.02	8.03	7.63	7
10	1.00	--	--	0.30	2.32	0.44	--	--	0.02	8.1	7.67	8
11	0.98	--	--	0.25	2.38	0.53	--	--	0.02	8.13	7.7	8
12	1.12	--	--	0.28	2.27	0.40	--	--	0.02	8.1	7.63	10
13	1.23	--	--	0.37	2.44	0.27	--	--	0.02	8.13	7.67	9
14	1.3	--	--	0.45	2.28	0.21	--	--	0.02	8.1	7.7	10
15	1.3	--	--	0.36	2.37	0.64	--	--	0.02	8.2	7.7	10

TABLE 2.1: PARTICULATE REMOVAL PROFILE (MAY/1986) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP.
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	(^{o}C)
16	1.1	--	--	0.41	2.65	0.45	--	--	0.02	8.1	7.7	10
17	1.0	--	--	0.37	2.52	0.35	--	--	0.02	8.1	7.7	9
18	0.83	--	--	0.35	2.30	0.25	--	--	0.02	8.1	7.7	9
19	0.78	--	--	0.40	2.35	0.13	--	--	0.02	8.1	7.7	9
20	0.98	--	--	0.45	2.32	0.18	--	--	0.02	8.2	7.7	10
21	N.A.	--	--	N.A.	2.20	0.20	--	--	N.A.	N.A.	N.A.	10
22	0.74	--	--	0.38	2.42	0.19	--	--	0.01	8.0	7.6	9
23	0.69	--	--	0.35	2.57	0.25	--	--	0.02	8.1	7.6	9
24	0.83	--	--	0.46	2.70	0.23	--	--	0.02	8.1	7.7	9
25	1.0	--	--	0.49	2.92	0.26	--	--	0.02	8.1	7.7	10
26	1.0	--	--	0.48	2.27	0.26	--	--	0.02	8.2	7.8	10
27	0.96	--	--	0.48	4.74	0.33	--	--	0.01	8.3	7.8	12
28	0.88	--	--	0.28	5.37	0.56	--	--	0.03	8.4	7.77	11
29	0.83	--	--	0.33	3.55	0.41	--	--	0.02	8.07	7.53	11
30	0.87	--	--	0.41	3.56	0.48	--	--	0.02	8.17	7.77	10
31	1.05	--	--	0.32	3.00	0.42	--	--	0.02	8.2	7.7	10

* Note - Facilities not available to record settled water and filtered [illegible]ate[illegible]rbid[illegible] lev[illegible]

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JUL./1986)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (°C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
1	0.94	--	--	0.33	2.86	0.21	--	--	0.02	8.13	7.63	13
2	0.89	--	--	0.39	2.79	0.31	--	--	0.02	7.97	7.76	15
3	0.81	--	--	0.40	2.41	0.23	--	--	0.03	8.03	7.67	16
4	0.91	--	--	0.45	2.00	0.29	--	--	0.04	8.0	7.7	15
5	1.08	--	--	0.32	2.64	0.35	--	--	0.05	7.93	7.63	10
6	1.12	--	--	0.24	2.74	0.32	--	--	0.05	7.97	7.6	11
7	1.09	--	--	0.28	3.10	0.30	--	--	0.05	8.07	7.5	12
8	1.26	--	--	0.31	3.06	0.29	--	--	0.03	7.87	7.47	10
9	1.3	--	--	0.32	4.06	0.39	--	--	0.03	8.0	7.6	9
10	1.0	--	--	0.24	2.92	0.41	--	--	0.02	8.1	7.7	10
11	1.12	--	--	0.30	3.42	0.31	--	--	0.03	8.2	7.77	13
12	1.52	--	--	0.45	4.66	0.31	--	--	0.04	8.07	7.63	17
13	1.61	--	--	0.60	3.80	0.42	--	--	0.05	8.1	7.6	18
14	1.56	--	--	0.49	2.55	0.23	--	--	0.05	8.1	7.7	13
15	1.09	--	--	0.32	3.51	0.38	--	--	0.03	8.0	7.6	14

TABLE 2.1: PARTICULATE REMOVAL PROFILE (JUL./1986) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^oC)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
16	1.25	--	--	0.39	3.71	0.40	--	--	0.04	8.03	7.57	14
17	1.2	--	--	0.45	3.23	0.37	--	--	0.04	8.0	7.5	16
18	1.3	--	--	0.43	3.98	0.40	--	--	0.04	8.1	7.5	16
19	1.5	--	--	0.45	4.04	0.36	--	--	0.04	8.1	7.5	19
20	1.3	--	--	0.38	3.82	0.37	--	--	0.04	8.1	7.6	20
21	1.6	--	--	0.44	4.56	0.48	--	--	0.05	8.1	7.5	20
22	1.5	--	--	0.28	4.69	0.47	--	--	0.05	8.1	7.5	22
23	1.4	--	--	0.29	4.88	0.31	--	--	0.05	8.1	7.5	19
24	1.2	--	--	0.21	4.57	0.36	--	--	0.05	8.1	7.5	19
25	1.0	--	--	0.24	4.18	0.32	--	--	0.05	8.1	7.4	18
26	1.0	--	--	0.24	4.17	0.33	--	--	0.05	8.1	7.5	17
27	1.1	--	--	0.28	4.03	0.30	--	--	0.03	8.1	7.4	19
28	1.6	--	--	0.48	3.55	0.32	--	--	0.06	8.1	7.5	20
29	1.2	--	--	0.24	4.34	0.39	--	--	0.04	8.1	7.4	20
30	1.83	--	--	0.31	5.15	0.47	--	--	0.05	8.07	7.43	21
31	2.12	--	--	0.32	5.52	0.49	--	--	0.05	8.1	7.43	22

* Note - Facilities not available to record settled water and filtered water turbidity levels.

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1986)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^oC)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
1	3.1	--	--	0.20	3.82	0.28	--	--	0.03	8.0	7.5	17
2	6.0	--	--	0.47	4.38	0.24	--	--	0.03	7.9	7.5	17
3	1.9	--	--	0.23	3.93	0.43	--	--	0.03	8.0	7.4	17
4	1.3	--	--	0.20	3.30	0.45	--	--	0.03	8.0	7.4	17
5	3.1	--	--	0.23	3.98	0.51	--	--	0.03	8.0	7.4	17
6	1.4	--	--	0.18	3.62	0.42	--	--	0.03	8.0	7.5	17
7	1.4	--	--	0.18	3.08	0.36	--	--	0.03	8.0	7.6	16
8	1.8	--	--	0.22	3.49	0.35	--	--	0.03	7.97	7.47	15
9	1.07	--	--	0.2	3.46	0.36	--	--	0.03	7.9	7.4	15
10	1.3	--	--	0.19	3.40	0.32	--	--	0.02	7.9	7.5	15
11	1.3	--	--	0.17	4.69	0.44	--	--	0.03	7.9	7.5	15
12	1.03	--	--	0.22	4.18	0.45	--	--	0.03	7.97	7.5	15
13	0.97	--	--	0.22	3.49	0.43	--	--	0.03	8.0	7.5	15
14	1.0	--	--	0.31	3.24	0.30	--	--	0.05	8.1	7.5	15
15	1.41	--	--	0.24	2.02	0.33	--	--	0.02	8.03	7.4	11

TABLE 2.1: PARTICULATE REMOVAL PROFILE (OCT./1986) (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	TURBIDITY (FTU)				COAGULANT	COAG. AID	FILTER AID*	METAL RES. Al/Fe (mg/L)		pH		TEMP. (^{o}C)
	Raw	Set*	Filter*	Treat.	mg/L	mg/L	mg/L	Raw*	Treat.	Raw	Treat.	
16	1.2	--	--	0.20	2.22	0.33	--	--	0.02	8.03	7.43	11
17	0.95	--	--	0.20	2.29	0.33	--	--	0.01	8.0	7.47	13
18	1.05	--	--	0.21	2.35	0.36	--	--	0.02	8.0	7.5	13
19	1.9	--	--	0.32	2.39	0.33	--	--	0.02	8.0	7.53	14
20	0.92	--	--	0.22	2.17	0.35	--	--	0.01	7.9	7.4	13
21	1.2	--	--	0.25	2.47	0.33	--	--	0.02	8.0	7.4	10
22	1.22	--	--	0.27	2.33	0.27	--	--	0.02	7.97	7.37	10
23	1.52	--	--	0.29	2.52	0.24	--	--	0.02	7.97	7.47	9
24	0.76	--	--	0.22	2.71	0.26	--	--	0.02	8.0	7.33	10
25	0.88	--	--	0.30	2.32	0.19	--	--	0.02	8.03	7.4	12
26	0.85	--	--	0.30	2.25	0.20	--	--	0.03	8.1	7.5	13
27	0.99	--	--	0.32	2.29	0.23	--	--	0.02	8.1	7.5	13
28	1.06	--	--	0.32	2.51	0.21	--	--	0.02	8.03	7.5	12
29	0.90	--	--	0.23	2.31	0.23	--	--	0.02	8.0	7.5	11
30	0.90	--	--	0.23	2.27	0.28	--	--	0.02	8.0	7.5	11
31	1.0	--	--	0.23	2.38	0.22	--	--	0.02	8.0	7.5	12

* Note - Facilities not available to record settled water and filtered [illegible]wate[illegible]rbi[illegible] le[illegible].

TABLE 3.0

DISINFECTION SUMMARY 1986, 1985

TABLE 3.0: DISINFECTION SUMMARY

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand	1.44	0.38	0.70	0.40	0.00	0.12	---	---	---	---	---	---
	Cl_2 Dosage	1.66	0.66	0.90	0.76	0.32	0.48	1.05	0.39	0.64	0.70	0.35	0.45
	Ammonia	0.16	0.03	0.07	0.07	0.02	0.04	---	---	---	0.15	0.00	0.01
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.26	0.16	0.21	0.65	0.51	0.57	---	---	---	0.67	0.33	0.43
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
FEB	Cl_2 Demand	1.43	0.48	0.74	0.29	0.00	0.07	0.71	0.23	0.39	0.29	0.11	0.22
	Cl_2 Dosage	1.57	0.70	0.93	0.67	0.34	0.43	0.88	0.41	0.58	0.55	0.35	0.45
	Ammonia	0.25	0.04	0.08	0.11	0.01	0.04	0.12	0.02	0.06	0.23	0.00	0.02
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.24	0.13	0.19	0.63	0.49	0.56	0.27	0.14	0.19	0.49	0.38	0.42
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
MAR	Cl_2 Demand	1.75	0.48	0.94	0.37	0.00	0.08	0.70	0.00	0.22	0.80	0.19	0.45
	Cl_2 Dosage	1.86	0.66	1.13	0.70	0.30	0.43	0.86	0.06	0.39	1.06	0.37	0.71
	Ammonia	0.32	0.01	0.09	0.09	0.00	0.03	0.28	0.04	0.12	0.15	0.02	0.06
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.27	0.08	0.19	0.69	0.44	0.56	0.32	0.11	0.19	0.54	0.34	0.45
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3.0: (cont'd)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand	1.26	0.55	0.81	0.23	0.00	0.07	0.51	0.00	0.15	1.03	0.13	0.39
	Cl_2 Dosage	1.47	0.75	0.99	0.61	0.30	0.44	0.70	0.12	0.33	1.33	0.55	0.74
	Ammonia	0.16	0.02	0.06	0.06	0.01	0.03	0.36	0.04	0.09	0.09	0.03	0.06
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.30	0.11	0.19	0.63	0.51	0.56	0.24	0.12	0.18	0.61	0.42	0.53
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
MAY	Cl_2 Demand	0.97	0.50	0.73	0.20	0.00	0.11	0.44	0.03	0.17	0.77	0.21	0.40
	Cl_2 Dosage	1.11	0.70	0.91	0.58	0.39	0.50	0.61	0.23	0.36	1.06	0.58	0.78
	Ammonia	0.08	0.03	0.05	0.11	0.01	0.03	0.14	0.04	0.07	0.10	0.04	0.07
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.23	0.12	0.18	0.60	0.53	0.57	0.29	0.12	0.19	0.62	0.51	0.57
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
JUN	Cl_2 Demand	1.58	0.87	1.11	0.21	0.00	0.08	0.58	0.00	0.18	1.29	0.57	0.87
	Cl_2 Dosage	1.65	1.03	1.22	0.68	0.40	0.51	0.81	0.23	0.43	1.56	0.87	1.16
	Ammonia	0.10	0.04	0.07	0.05	0.01	0.03	0.13	0.03	0.09	0.09	0.04	0.06
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.21	0.05	0.11	0.61	0.51	0.54	0.34	0.19	0.26	0.61	0.47	0.55
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3.0: (cont'd)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand	1.40	0.81	1.14	0.18	0.00	0.08	0.20	0.00	0.02	1.57	0.65	0.92
	Cl_2 Dosage	1.56	1.06	1.32	0.59	0.34	0.46	0.45	0.15	0.25	1.81	0.92	1.15
	Ammonia	0.10	0.04	0.06	0.05	0.01	0.03	0.11	0.04	0.07	0.09	0.02	0.05
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.29	0.12	0.19	0.66	0.53	0.57	0.42	0.23	0.33	0.64	0.50	0.55
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
AUG	Cl_2 Demand	1.56	0.80	1.15	0.16	0.00	0.05	1.97	0.00	0.74	1.06	0.05	0.60
	Cl_2 Dosage	1.68	0.96	1.30	0.66	0.38	0.47	2.09	0.18	0.93	1.40	0.52	0.99
	Ammonia	0.10	0.02	0.05	0.05	0.00	0.02	0.16	0.05	0.10	0.12	0.04	0.08
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.21	0.09	0.15	0.65	0.49	0.57	0.32	0.07	0.20	0.67	0.47	0.58
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
SEP	Cl_2 Demand	1.40	0.62	0.95	0.15	0.00	0.06	2.88	1.04	1.56	0.45	0.00	0.17
	Cl_2 Dosage	1.49	0.87	1.21	0.59	0.31	0.43	3.38	1.19	1.78	0.88	0.00	0.55
	Ammonia	0.07	0.00	0.03	0.03	0.00	0.01	0.14	0.03	0.08	0.14	0.01	0.06
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.35	0.15	0.22	0.72	0.52	0.60	0.50	0.12	0.21	0.69	0.43	0.61
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3.0: (cont'd)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1986						1985					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand	1.46	0.48	0.98	0.19	0.00	0.05	1.37	0.44	0.80	0.35	0.03	0.14
	Cl_2 Dosage	1.64	0.76	1.20	0.52	0.26	0.41	1.68	0.63	0.98	0.83	0.40	0.54
	Ammonia	0.08	0.01	0.04	0.03	0.00	0.01	0.12	0.02	0.07	0.08	0.02	0.05
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.33	0.14	0.22	0.67	0.54	0.60	0.26	0.13	0.19	0.67	0.51	0.58
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
NOV	Cl_2 Demand	0.97	0.48	0.73	0.21	0.00	0.06	1.65	0.78	1.20	0.35	0.00	0.12
	Cl_2 Dosage	1.26	0.69	0.96	0.46	0.29	0.35	1.87	0.96	1.37	0.91	0.39	0.60
	Ammonia	0.06	0.00	0.03	0.03	0.00	0.01	0.21	0.08	0.12	0.19	0.04	0.07
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.30	0.17	0.23	0.61	0.43	0.52	0.25	0.11	0.17	0.72	0.53	0.65
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---
DEC	Cl_2 Demand	0.83	0.41	0.61	0.19	0.00	0.07	1.41	0.61	0.91	0.42	0.00	0.11
	Cl_2 Dosage	1.00	0.59	0.80	0.48	0.25	0.36	1.53	0.82	1.09	0.82	0.21	0.49
	Ammonia	0.14	0.01	0.04	0.06	0.00	0.01	0.19	0.03	0.07	0.10	0.01	0.04
	SO_2	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Free	0.25	0.08	0.18	0.54	0.40	0.48	0.28	0.10	0.18	0.62	0.52	0.57
	Resid. CL_2 Comb.	---	---	---	---	---	---	---	---	---	---	---	---
	Resid. CL_2 Total	---	---	---	---	---	---	---	---	---	---	---	---

NOTE: Document - Method of sample collection - Method of analyses, frequency, and by whom

TABLE 3.1

DISINFECTION SUMMARY 1984

TABLE 3.1: DISINFECTION SUMMARY

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JAN	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	0.82	0.48	0.62	0.57	0.29	0.41						
	Ammonia	0.17	0.06	0.11	0.24	0.03	0.10						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.45	0.19	0.30						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
FEB	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.35	0.48	0.80	0.68	0.26	0.47						
	Ammonia	0.23	0.07	0.13	0.33	0.04	0.14						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.55	0.15	0.35						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
MAR	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.77	0.54	0.86	0.70	0.32	0.50						
	Ammonia	0.21	0.09	0.15	0.93	0.04	0.17						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.61	0.21	0.39						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
APR	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.06	0.49	0.74	0.60	0.32	0.48						
	Ammonia	0.36	0.11	0.16	0.24	0.05	0.12						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.50	0.19	0.37						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
MAY	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.47	0.54	0.76	0.70	0.32	0.52						
	Ammonia	---	---	---	0.07	0.06	0.07						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.60	0.22	0.39						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
JUN	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.21	0.73	0.87	0.80	0.59	0.68						
	Ammonia	0.07	0.02	0.04	0.20	0.00	0.05						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.69	0.49	0.58						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
JUL	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	0.93	0.61	0.77	0.80	0.53	0.63						
	Ammonia	0.10	0.06	0.08	0.20	0.01	0.06						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.69	0.43	0.53						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
AUG	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.74	0.86	1.19	0.82	0.46	0.66						
	Ammonia	0.18	0.11	0.14	0.18	0.00	0.06						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.75	0.46	0.58						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
SEP	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.48	0.74	1.08	0.79	0.51	0.62						
	Ammonia	---	---	---	0.21	0.00	0.08						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.71	0.44	0.55						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						

TABLE 3.1: (cont'd)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		1984						1983					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
OCT	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.42	0.66	1.02	0.72	0.48	0.61						
	Ammonia	0.06	0.02	0.04	0.04	0.01	0.01						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.64	0.41	0.53						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
NOV	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	1.30	0.54	0.89	0.76	0.49	0.62						
	Ammonia	---	---	---	0.06	0.00	0.02						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.72	0.39	0.53						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						
DEC	Cl_2 Demand	---	---	---	---	---	---						
	Cl_2 Dosage	0.98	0.56	0.74	0.73	0.33	0.55						
	Ammonia	---	---	---	0.06	0.00	0.01						
	SO_2	---	---	---	---	---	---						
	Resid. CL_2 Free	---	---	---	0.66	0.20	0.46						
	Resid. CL_2 Comb.	---	---	---	---	---	---						
	Resid. CL_2 Total	---	---	---	---	---	---						

NOTE: Document - Method of sample collection - Method of analyses, frequency, and by whom

TABLE 3.2

DISINFECTION PROFILE
(JANUARY, MAY, JULY, OCTOBER)/1984

TABLE 3.2: DISINFECTION PROFILE (JANUARY 1984)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
1		0.56	**						0.31	0.05		0.19		
2		0.59	**						0.40	0.10		0.27		
3		0.69	**						0.37	0.12		0.25		
4		0.54	0.13						0.37	0.24		0.25		
5		0.48	0.14						0.35	0.11		0.23		
6		0.48	0.12						0.45	0.10		0.33		
7		0.50	0.09						0.34	0.06		0.22		
8		0.50	0.09						0.29	0.08		0.23		
9		0.57	0.06						0.38	0.03		0.26		
10		0.50	0.17						0.38	0.15		0.25		
11		0.69	**						0.37	0.12		0.26		
12		0.53	**						0.44	0.14		0.31		
13		0.68	**						0.42	0.22		0.34		
14		0.66	**						0.57	0.19		0.45		
15		0.60	**						0.41	**		0.41		

TABLE 3.2: JANUARY 1984 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.**	Dos.	**		Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
16		0.61							0.45	0.19		0.33		
17		0.60							0.46	0.06		0.33		
18		0.58							0.39	0.10		0.28		
19		0.82							0.48	0.16		0.37		
20		0.82							0.47	0.11		0.35		
21		0.62							0.40	0.08		0.29		
22		0.65							0.49	0.07		0.37		
23		0.66							0.39	0.11		0.26		
24		0.79							0.52	0.10		0.38		
25		0.69							0.44	0.11		0.32		
26		0.55							0.42	0.03		0.30		
27		0.62							0.44	0.04		0.30		
28		0.58							0.36	0.03		0.23		
29		0.70							0.46	0.06		0.34		
30		0.67							0.40	0.07		0.27		
31		0.78							0.44	0.08		0.31		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (MAY 1984)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.**	Dos.	**		Free **	Comb. *	Total*	Dem.**	Dos.	**		Free	Comb. *	Total*
1		0.63							0.48			0.40		
2		0.54							0.47			0.34		
3		0.57							0.58			0.46		
4		0.82							0.56			0.46		
5		0.79							0.56			0.45		
6		0.83							0.49			0.37		
7		0.74							0.52			0.34		
8		0.69							0.47			0.37		
9		0.62							0.37			0.27		
10		0.68							0.36			0.28		
11		0.63							0.32			0.22		
12		1.47							0.70			0.60		
13		0.79							0.42			0.31		
14		0.58							0.42			0.31		
15		0.77							0.57			0.45		

TABLE 3.2: MAY 1984 (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.**	Dos.	**		Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
16		0.75							0.50	**		0.36		
17		0.72							0.53	**		0.41		
18		0.70							0.52	**		0.38		
19		0.69							0.48	**		0.38		
20		0.74							0.58	**		0.48		
21		0.82							0.49	**		0.40		
22		0.70							0.60	**		0.42		
23		0.62							0.49	**		0.40		
24		0.68							0.46	**		0.37		
25		0.86							0.43	**		0.34		
26		0.82							0.47	**		0.36		
27		0.95							0.54	**		0.43		
28		1.04							0.65	**		0.60		
29		0.78							0.66	**		0.54		
30		0.86							0.66	0.07		0.55		
31		0.77							0.66	0.06		0.54		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (JULY 1984)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.**	Dos.	**		Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
1		0.87							0.80	0.02		0.69		
2		0.80							0.66	0.01		0.55		
3		0.75							0.63	0.01		0.53		
4		0.79							0.56	0.01		0.46		
5		0.79							0.61	0.06		0.51		
6		0.89							0.74	0.04		0.63		
7		0.90							0.55	0.01		0.45		
8		0.78							0.53	0.01		0.43		
9		0.76							0.60	0.02		0.49		
10		0.81							0.59	0.09		0.49		
11		0.87							0.72	0.16		0.61		
12		0.75							0.68	0.09		0.57		
13		0.93							0.74	0.13		0.64		
14		0.75							0.71	0.10		0.61		
15		0.73							0.60	0.09		0.53		

TABLE 3.2: JULY 1984 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
16		0.65	**						0.69	0.06		0.60		
17		0.77	**						0.60	0.12		0.47		
18		0.75	0.10						0.57	0.06		0.47		
19		0.77	0.06						0.68	0.03		0.57		
20		0.69	0.08						0.60	0.04		0.43		
21		0.73	0.07						0.57	0.03		0.44		
22		0.84	0.09						0.67	0.02		0.50		
23		0.72	0.08						0.56	0.04		0.46		
24		0.68	0.08						0.63	0.04		0.54		
25		0.61	**						0.56	0.12		0.48		
26		0.68	**						0.64	0.02		0.55		
27		0.69	**						0.62	0.03		0.51		
28		0.70	**						0.61	0.08		0.52		
29		0.75	**						0.61	0.20		0.51		
30		0.72	**						0.63	0.07		0.54		
31		0.87	**						0.66	0.10		0.59		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1984)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
1		1.05	**						0.61	0.01		0.53		
2		1.05	**						0.61	0.01		0.52		
3		0.98	**						0.54	0.01		0.45		
4		0.66	**						0.48	0.01		0.41		
5		0.69	**						0.60	0.00		0.51		
6		0.69	**						0.53	0.00		0.46		
7		0.76	**						0.50	0.00		0.48		
8		0.80	**						0.58	0.00		0.50		
9		0.73	**						0.56	0.01		0.48		
10		0.84	**						0.61	0.01		0.53		
11		0.80	0.03						0.52	0.01		0.50		
12		0.81	0.06						0.52	**		0.44		
13		0.70	**						0.59	0.04		0.51		
14		1.02	0.02						0.56	0.00		0.49		
15		1.07	0.05						0.65	0.02		0.58		

TABLE 3.2: OCTOBER 1984 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
16		0.97	0.03						0.64	0.01		0.55		
17		0.96	**						0.68	0.02		0.60		
18		1.08	**						0.64	0.01		0.57		
19		1.12	**						0.70	0.01		0.62		
20		1.29	**						0.71	0.01		0.63		
21		1.26	**						0.58	0.01		0.51		
22		1.22	**						0.72	0.00		0.64		
23		1.32	**						0.67	0.01		0.60		
24		1.40	**						0.61	0.00		0.53		
25		1.42	**						0.69	0.00		0.55		
26		1.21	**						0.63	0.00		0.55		
27		1.00	**						0.62	0.03		0.52		
28		1.16	**						0.58	0.01		0.50		
29		1.29	**						0.66	0.01		0.58		
30		1.00	**						0.59	0.00		0.50		
31		1.18	**						0.60	0.04		0.51		

* Data not recorded.
** Data not available.

TABLE 3.2

DISINFECTION PROFILE (JANUARY, MAY, JULY, OCTOBER)/1985

TABLE 3.2: DISINFECTION PROFILE (JANUARY 1985)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3**	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
1		0.71							0.43	0.15		0.41		
2		1.05							0.70	0.00		0.67		
3		0.86							0.49	0.00		0.46		
4		0.72							0.35	0.00		0.33		
5		0.78							0.39	0.00		0.37		
6		0.66							0.45	0.00		0.42		
7		0.80							0.46	0.00		0.40		
8		0.58							0.54	0.00		0.51		
9		0.71							0.52	0.01		0.49		
10		0.70							0.42	0.00		0.39		
11		0.73							0.50	0.00		0.47		
12		0.69							0.49	0.00		0.46		
13		0.75							0.55	0.01		0.52		
14		0.77							0.41	0.00		0.39		
15		0.73							0.55	0.00		0.53		

TABLE 3.2: JANUARY 1985 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3**	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.**	Dos.			Free **	Comb. *	Total*	Dem.**	Dos.			Free	Comb. *	Total*
16		0.57							0.40	0.00		0.37		
17		0.54							0.43	0.00		0.40		
18		0.55							0.45	0.00		0.42		
19		0.61							0.54	0.00		0.51		
20		0.76							0.44	0.00		0.41		
21		0.62							0.46	0.00		0.44		
22		0.46							0.36	0.00		0.33		
23		0.47							0.43	0.01		0.41		
24		0.57							0.44	0.01		0.42		
25		0.50							0.43	0.01		0.41		
26		0.49							0.41	0.01		0.37		
27		0.59							0.40	0.04		0.38		
28		0.51							0.41	0.03		0.39		
29		0.43							0.39	0.01		0.36		
30		0.39							0.40	0.01		0.36		
31		0.55							0.42	0.00		0.39		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (MAY 1985)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

	PRE-CHLORINATION							POST-CHLORINATION						
DATE	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	0.19	0.35	0.09		0.16			0.33	0.74	0.07		0.57		
2	0.15	0.35	0.05		0.20			0.27	0.63	0.09		0.56		
3	0.17	0.35	0.05		0.18			0.21	0.58	0.08		0.55		
4	0.20	0.37	0.07		0.17			0.35	0.77	0.06		0.59		
5	0.10	0.24	0.05		0.14			0.32	0.77	0.09		0.59		
6	0.09	0.31	0.06		0.22			0.46	0.82	0.07		0.58		
7	0.08	0.33	0.07		0.25			0.33	0.68	0.07		0.60		
8	0.12	0.31	0.08		0.19			0.36	0.75	0.07		0.58		
9	0.03	0.24	0.05		0.21			0.35	0.73	0.04		0.59		
10	0.11	0.28	0.06		0.17			0.38	0.79	0.06		0.58		
11	0.06	0.28	0.04		0.22			0.32	0.68	0.04		0.58		
12	0.23	0.35	0.09		0.12			0.48	0.92	0.08		0.56		
13	0.32	0.61	0.14		0.29			0.31	0.64	0.07		0.62		
14	0.20	0.36	0.11		0.16			0.41	0.83	0.09		0.58		
15	0.20	0.34	0.07		0.14			0.33	0.75	0.07		0.56		

TABLE 3.2: MAY 1985 (cont'd) BURLINGTON WATER PURIFICATION PLANT

	PRE-CHLORINATION							POST-CHLORINATION						
DATE	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.18	0.36	0.07		0.18			0.30	0.70	0.07		0.58		
17	0.15	0.31	0.05		0.16			0.25	0.64	0.08		0.55		
18	0.28	0.44	0.05		0.16			0.23	0.62	0.08		0.55		
19	0.08	0.28	0.05		0.20			0.33	0.69	0.07		0.56		
20	0.33	0.48	0.06		0.15			0.32	0.70	0.06		0.53		
21	0.34	0.48	0.10		0.14			0.48	0.88	0.09		0.54		
22	0.32	0.47	0.06		0.15			0.39	0.82	0.08		0.58		
23	0.24	0.42	0.06		0.18			0.38	0.79	0.05		0.59		
24	0.12	0.30	0.06		0.18			0.35	0.71	0.05		0.54		
25	0.20	0.45	0.04		0.25			0.38	0.68	0.04		0.55		
26	0.04	0.29	0.06		0.25			0.77	1.03	0.08		0.51		
27	0.12	0.30	0.08		0.18			0.63	1.06	0.10		0.61		
28	0.03	0.23	0.06		0.20			0.63	0.98	0.06		0.55		
29	0.05	0.26	0.05		0.21			0.56	0.91	0.06		0.56		
30	**	0.31	**		**			**	0.88	**		**		
31	0.44	0.59	0.09		0.15			0.68	1.04	0.09		0.51		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (JULY 1985)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	0.16	0.36	0.07		0.23			0.70	0.99	0.05		0.52		
2	0.20	0.43	0.05		0.23			0.78	1.10	0.09		0.55		
3	0.07	0.35	0.05		0.28			0.73	1.06	0.07		0.61		
4	0.00	0.27	0.07		0.27			0.77	1.04	0.07		0.54		
5	0.00	0.30	0.08		0.36			0.92	1.06	0.04		0.50		
6	0.00	0.27	0.07		0.37			1.00	1.25	0.05		0.62		
7	0.05	0.45	0.06		0.40			1.57	1.81	0.02		0.64		
8	0.00	0.30	0.07		0.34			1.04	1.24	0.05		0.54		
9	0.00	0.22	0.07		0.39			1.11	1.25	0.06		0.53		
10	0.00	0.22	0.07		0.34			1.12	1.29	0.05		0.51		
11	0.00	0.20	0.08		0.37			1.04	1.22	0.07		0.55		
12	0.00	0.18	0.06		0.42			1.32	1.43	0.06		0.53		
13	0.00	0.17	0.05		0.37			1.10	1.26	0.08		0.53		
14	0.00	0.18	0.05		0.38			1.29	1.42	0.08		0.51		
15	0.00	0.26	0.06		0.38			1.14	1.30	0.05		0.54		

TABLE 3.2: JULY 1985 (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.00	0.20	0.06		0.34			1.07	1.32	0.05		0.59		
17	0.00	0.19	0.06		0.38			0.93	1.16	0.06		0.61		
18	0.00	0.24	0.04		0.33			0.85	1.16	0.03		0.64		
19	0.00	0.34	0.08		0.36			0.82	1.04	0.07		0.58		
20	0.00	0.28	0.07		0.34			0.79	1.02	0.04		0.57		
21	0.00	0.22	0.07		0.30			0.85	1.11	0.03		0.56		
22	0.00	0.22	0.05		0.30			0.73	1.04	0.05		0.61		
23	0.00	0.24	0.06		0.32			0.88	1.07	0.04		0.51		
24	0.00	0.17	0.06		0.31			0.97	1.16	0.05		0.50		
25	0.00	0.22	0.09		0.30			0.72	0.96	0.06		0.54		
26	0.00	0.22	0.06		0.30			0.66	0.92	0.04		0.56		
27	0.00	0.15	0.05		0.30			0.69	0.92	0.02		0.53		
28	0.00	0.24	0.06		0.27			0.65	0.93	0.04		0.55		
29	0.00	0.15	0.09		0.30			0.82	1.07	0.06		0.55		
30	0.00	0.17	0.07		0.31			0.70	0.93	0.09		0.54		
31	0.05	0.29	0.11		0.24			0.82	1.12	0.06		0.54		

* Data not recorded.
** Data not available.

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1985)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	1.37	1.68	0.09		0.31			0.16	0.47	0.07		0.62		
2	0.66	0.87	0.05		0.21			0.04	0.44	0.04		0.61		
3	0.93	1.09	0.09		0.16			0.35	0.83	0.07		0.64		
4	0.79	1.03	0.09		0.24			0.03	0.41	0.06		0.62		
5	0.79	0.97	0.05		0.18			0.23	0.63	0.02		0.58		
6	0.66	0.90	0.06		0.24			0.16	0.56	0.04		0.64		
7	0.46	0.69	0.06		0.23			0.12	0.49	0.05		0.58		
8	0.55	0.68	0.07		0.13			0.11	0.56	0.08		0.58		
9	0.51	0.70	0.06		0.19			0.07	0.41	0.07		0.53		
10	0.61	0.83	0.07		0.22			0.09	0.47	0.04		0.60		
11	0.76	0.92	0.08		0.16			0.16	0.57	0.07		0.57		
12	0.71	0.95	0.07		0.24			0.18	0.49	0.05		0.55		
13	0.79	0.97	0.10		0.18			0.17	0.56	0.06		0.57		
14	0.59	0.81	0.07		0.22			0.19	0.53	0.05		0.56		
15	0.61	0.78	0.06		0.17			0.17	0.53	0.05		0.53		

TABLE 3.2: OCTOBER 1985 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

	PRE-CHLORINATION							POST-CHLORINATION						
DATE	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.66	0.86	0.05		0.20			0.17	0.54	0.05		0.57		
17	0.44	0.63	0.06		0.19			0.06	0.40	0.05		0.53		
18	0.69	0.85	0.02		0.16			0.05	0.46	0.02		0.57		
19	0.98	1.17	0.05		0.19			0.16	0.58	0.02		0.61		
20	0.80	0.97	0.07		0.17			0.19	0.55	0.04		0.53		
21	1.00	1.14	0.04		0.14			0.05	0.47	0.03		0.56		
22	0.94	1.20	0.05		0.26			0.07	0.48	0.03		0.67		
23	1.01	1.19	0.06		0.18			0.12	0.53	0.03		0.59		
24	0.82	0.95	0.09		0.13			0.18	0.62	0.05		0.57		
25	0.92	1.07	0.09		0.15			0.23	0.64	0.04		0.56		
26	1.01	1.14	0.09		0.13			0.21	0.68	0.05		0.60		
27	1.06	1.19	0.12		0.13			0.17	0.63	0.07		0.59		
28	1.03	1.19	0.07		0.16			0.05	0.51	0.06		0.62		
29	**	**	**		**			**	**	0.03		0.57		
30	0.93	1.06	0.09		0.13			0.28	0.66	0.03		0.51		
31	0.85	1.00	0.05		0.15			0.06	0.53	0.04		0.62		

* Data not recorded.
** Data not available.

TABLE 3.2

DISINFECTION PROFILE (JANUARY, MAY, JULY, OCTOBER)/1986

TABLE 3.2: DISINFECTION PROFILE (JANUARY 1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	0.64	0.82	0.09		0.18			0.16	0.56	0.06		0.58		
2	0.86	1.03	0.09		0.17			0.19	0.59	0.05		0.57		
3	0.90	1.08	0.09		0.18			0.18	0.56	0.04		0.56		
4	0.87	1.04	0.08		0.17			0.29	0.67	0.05		0.55		
5	0.92	1.10	0.07		0.18			0.06	0.42	0.04		0.54		
6	1.44	1.66	0.16		0.22			0.40	0.76	0.07		0.58		
7	0.66	0.89	0.08		0.23			0.13	0.53	0.05		0.63		
8	0.72	0.94	0.05		0.22			0.23	0.54	0.04		0.53		
9	0.57	0.74	0.07		0.17			0.15	0.51	0.05		0.53		
10	0.61	0.80	0.08		0.19			0.11	0.47	0.04		0.55		
11	0.60	0.78	0.06		0.18			0.11	0.47	0.05		0.54		
12	0.72	0.95	0.06		0.23			0.13	0.48	0.04		0.58		
13	0.63	0.84	0.05		0.22			0.12	0.42	0.04		0.52		
14	0.56	0.77	0.07		0.21			0.13	0.44	0.04		0.52		
15	0.67	0.87	0.06		0.20			0.13	0.52	0.03		0.59		

TABLE 3.2: JANUARY/1986(cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.66	0.90	0.07		0.24			0.17	0.54	0.05		0.61		
17	0.66	0.87	0.07		0.21			0.11	0.51	0.05		0.61		
18	0.52	0.74	0.16		0.22			0.20	0.57	0.05		0.59		
19	0.60	0.81	0.07		0.21			0.17	0.57	0.05		0.61		
20	0.92	1.13	0.08		0.21			0.16	0.53	0.04		0.58		
21	0.74	1.00	0.08		0.26			0.08	0.39	0.04		0.57		
22	0.56	0.78	0.06		0.22			0.00	0.33	0.03		0.56		
23	0.38	0.63	0.06		0.25			0.02	0.32	0.03		0.55		
24	0.45	0.66	0.05		0.21			0.00	0.36	0.03		0.65		
25	0.78	0.94	0.06		0.16			0.06	0.45	0.04		0.55		
26	0.76	0.94	0.04		0.18			0.10	0.46	0.02		0.54		
27	0.77	0.96	0.06		0.19			0.06	0.38	0.02		0.51		
28	0.56	0.76	0.06		0.20			0.04	0.37	0.03		0.53		
29	0.53	0.74	0.06		0.21			0.07	0.40	0.03		0.54		
30	0.72	0.94	0.03		0.22			0.00	0.36	0.02		0.61		
31	0.65	0.88	0.04		0.23			0.05	0.37	0.02		0.55		

* Data not recorded

TABLE 3.2: DISINFECTION PROFILE (MAY/1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	0.86	0.98	0.05		0.12			0.03	0.49	0.02		0.58		
2	0.84	1.05	0.05		0.21			0.11	0.45	0.02		0.55		
3	0.64	0.86	0.04		0.22			0.03	0.41	0.02		0.60		
4	0.64	0.83	0.04		0.19			0.00	0.39	0.02		0.60		
5	0.59	0.79	0.03		0.20			0.00	0.39	0.02		0.60		
6	0.50	0.70	0.04		0.20			0.09	0.46	0.02		0.57		
7	0.64	0.82	0.08		0.18			0.07	0.46	0.04		0.57		
8	0.62	0.79	0.05		0.17			0.14	0.50	0.03		0.53		
9	0.62	0.80	0.05		0.18			0.08	0.43	0.02		0.53		
10	0.53	0.75	0.04		0.22			0.13	0.48	0.01		0.57		
11	0.51	0,71	0.04		0.20			0.05	0.44	0.01		0.59		
12	0.63	0.83	0.05		0.20			0.11	0.48	0.02		0.57		
13	0.61	0.84	0.05		0.23			0.15	0.50	0.02		0.58		
14	0.61	0.82	0.06		0.21			0.11	0.48	0.03		0.58		
15	0.78	0.95	0.05		0.17			0.20	0.56	0.02		0.53		

TABLE 3.2: MAY/1986 (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.74	0.91	0.07		0.17			0.13	0.50	0.02		0.54		
17	0.70	0.91	0.03		0.21			0.13	0.49	0.01		0.57		
18	0.68	0.87	0.06		0.19			0.09	0.50	0.03		0.60		
19	0.76	0.96	0.06		0.20			0.12	0.49	0.03		0.57		
20	0.78	0.94	0.06		0.16			0.11	0.48	0.03		0.53		
21	N.A.	N.A.	N.A.		N.A.			N.A.	N.A.	N.A.		N.A.		
22	0.87	1.08	0.06		0.21			0.12	0.49	0.04		0.58		
23	0.78	0.96	0.05		0.18			0.11	0.52	0.03		0.59		
24	0.89	1.09	0.04		0.20			0.12	0.49	0.02		0.57		
25	0.97	1.11	0.04		0.14			0.16	0.55	0.02		0.53		
26	0.93	1.09	0.04		0.16			0.15	0.58	0.02		0.59		
27	0.83	1.03	0.06		0.20			0.20	0.55	0.05		0.55		
28	0.75	0.87	0.05		0.12			0.15	0.56	0.11		0.53		
29	0.84	0.96	0.07		0.12			0.11	0.59	0.06		0.60		
30	0.82	0.96	0.07		0.14			0.12	0.57	0.04		0.59		
31	0.90	1.04	0.08		0.14			0.12	0.57	0.07		0.59		

* Data not recorded.

TABLE 3.2: DISINFECTION PROFILE (JULY/1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	1.28	1.45	0.07		0.17			0.11	0.50	0.02		0.56		
2	1.26	1.42	0.06		0.16			0.15	0.57	0.02		0.58		
3	0.99	1.16	0.04		0.17			0.03	0.40	0.02		0.54		
4	1.08	1.23	0.06		0.15			0.00	0.35	0.02		0.56		
5	0.84	1.08	0.06		0.24			0.08	0.40	0.02		0.56		
6	0.81	1.10	0.07		0.29			0.18	0.47	0.03		0.58		
7	1.21	1.46	0.07		0.25			0.04	0.40	0.03		0.61		
8	1.07	1.24	0.06		0.17			0.00	0.39	0.02		0.56		
9	0.95	1.20	0.06		0.25			0.08	0.45	0.05		0.62		
10	1.20	1.39	0.06		0.19			0.09	0.49	0.01		0.59		
11	1.24	1.46	0.04		0.22			0.01	0.42	0.01		0.63		
12	1.18	1.42	0.05		0.24			0.00	0.42	0.02		0.66		
13	1.34	1.48	0.06		0.14			0.04	0.49	0.04		0.59		
14	0.88	1.06	0.05		0.18			0.03	0.40	0.02		0.55		
15	0.92	1.18	0.08		0.25			0.08	0.42	0.05		0.60		

TABLE 3.2: **JULY/1986** (cont'd)

BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.96	1.14	0.07		0.18			0.05	0.43	0.04		0.56		
17	0.89	1.10	0.05		0.21			0.09	0.42	0.03		0.54		
18	1.18	1.38	0.07		0.20			0.15	0.48	0.04		0.53		
19	1.40	1.56	0.10		0.16			0.08	0.52	0.04		0.60		
20	1.33	1.52	0.07		0.19			0.15	0.51	0.02		0.55		
21	1.03	1.15	0.08		0.12			0.13	0.55	0.03		0.54		
22	1.24	1.37	0.06		0.13			0.06	0.48	0.03		0.55		
23	1.27	1.41	0.08		0.14			0.11	0.52	0.03		0.55		
24	1.29	1.50	0.08		0.21			0.14	0.51	0.02		0.58		
25	1.25	1.47	0.05		0.22			0.11	0.48	0.02		0.59		
26	1.31	1.47	0.05		0.16			0.18	0.57	0.02		0.55		
27	1.19	1.37	0.04		0.18			0.02	0.41	0.02		0.57		
28	0.93	1.07	0.06		0.14			0.00	0.34	0.02		0.58		
29	1.30	1.45	0.06		0.15			0.03	0.45	0.02		0.57		
30	1.18	1.37	0.06		0.19			0.03	0.42	0.03		0.58		
31	1.22	1.32	0.04		0.10			0.12	0.59	0.04		0.57		

* Data not recorded.

TABLE 3.2: DISINFECTION PROFILE (OCTOBER 1986)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2*	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
1	1.26	1.40	0.05		0.14			0.11	0.52	0.02		0.55		
2	1.41	1.56	0.08		0.15			0.09	0.50	0.01		0.56		
3	1.46	1.62	0.06		0.16			0.00	0.44	0.01		0.60		
4	1.45	1.64	0.06		0.19			0.00	0.38	0.01		0.59		
5	1.39	1.55	0.08		0.16			0.00	0.42	0.02		0.58		
6	1.09	1.29	0.06		0.20			0.00	0.37	0.01		0.60		
7	0.98	1.22	0.06		0.24			0.08	0.39	0.01		0.55		
8	1.05	1.26	0.08		0.21			0.04	0.37	0.01		0.64		
9	1.20	1.36	0.05		0.16			0.00	0.43	0.01		0.65		
10	1.07	1.31	0.02		0.24			0.00	0.36	0.00		0.67		
11	1.30	1.50	0.04		0.20			0.00	0.42	0.01		0.64		
12	1.23	1.40	0.02		0.17			0.00	0.33	0.01		0.65		
13	1.05	1.25	0.01		0.20			0.06	0.49	0.00		0.63		
14	0.95	1.16	0.06		0.21			0.00	0.35	0.03		0.60		
15	0.48	0.76	0.01		0.28			0.01	0.34	0.00		0.61		

TABLE 3.2: OCTOBER 1986 (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PRE-CHLORINATION							POST-CHLORINATION						
	Cl_2		NH_3	SO_2 *	RESIDUAL CL_2			Cl_2		NH_3	SO_2 *	RESIDUAL CL_2		
	Dem.	Dos.			Free	Comb. *	Total*	Dem.	Dos.			Free	Comb. *	Total*
16	0.60	0.83	0.02		0.23			0.02	0.36	0.00		0.57		
17	0.87	1.09	0.03		0.22			0.04	0.37	0.00		0.55		
18	0.98	1.19	0.04		0.21			0.01	0.43	0.01		0.63		
19	0.94	1.18	0.03		0.24			0.04	0.41	0.00		0.61		
20	0.84	1.07	0.02		0.23			0.06	0.44	0.00		0.61		
21	0.67	0.95	0.03		0.28			0.08	0.39	0.00		0.59		
22	0.93	1.26	0.02		0.33			0.19	0.51	0.00		0.65		
23	0.62	0.94	0.01		0.32			0.14	0.26	0.00		0.54		
24	0.99	1.22	0.04		0.23			0.04	0.39	0.02		0.58		
25	0.86	1.03	0.04		0.17			0.00	0.39	0.01		0.60		
26	0.80	1.00	0.04		0.20			0.09	0.45	0.01		0.56		
27	0.78	0.98	0.06		0.20			0.04	0.41	0.03		0.57		
28	0.77	1.05	0.06		0.28			0.12	0.48	0.01		0.64		
29	0.72	0.95	0.07		0.23			0.07	0.43	0.01		0.59		
30	0.81	1.04	0.02		0.23			0.19	0.50	0.00		0.54		
31	0.84	1.04	0.05		0.20			0.01	0.39	0.00		0.58		

* Data not recorded.

TABLE 4.0

T & O CONTROL, ALKALINITY ADJ. & FLUORIDATION SUMMARY

1984 -1986

Page 1 of 2

TABLE 4.0: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION SUMMARY

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

		1986			1985			1984			1983		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
JAN	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.05	0.13	0.09	0.34	0.43	0.39			
	F Dos.	0.42	0.62	0.51	0.36	0.48	0.43	0.39	0.51	0.45			
	F. Res.	0.94	1.04	1.00	0.90	1.15	1.01	0.90	1.03	0.95			
FEB	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.09	0.13	0.12	0.34	0.45	0.39			
	F Dos.	0.43	0.59	0.48	0.30	0.41	0.37	0.31	0.55	0.40			
	F Res.	0.90	1.08	1.01	0.96	1.12	1.02	0.95	1.18	1.03			
MAR	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.05	0.14	0.09	0.29	0.45	0.35			
	F Dos.	0.39	0.48	0.44	0.32	0.52	0.41	0.31	0.44	0.35			
	F Res.	0.95	1.09	1.01	0.94	1.05	1.00	0.93	1.12	1.03			
APR	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.06	0.14	0.08	0.33	0.40	0.36			
	F Dos.	0.37	0.50	0.42	0.38	0.55	0.43	0.34	0.66	0.50			
	F Res.	0.95	1.08	1.01	0.95	1.14	1.02	0.94	1.10	1.00			
MAY	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.05	0.14	0.08	0.26	0.44	0.34			
	F Dos.	0.37	0.52	0.43	0.32	0.45	0.39	0.47	0.62	0.55			
	F Res.	0.93	1.05	0.99	0.96	1.10	1.01	0.91	1.09	1.00			
JUN	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.04	0.15	0.09	0.28	0.38	0.33			
	F Dos.	0.20	0.52	0.36	0.34	0.53	0.43	0.43	0.70	0.51			
	F Res.	0.95	1.10	1.00	0.97	1.06	1.01	0.94	1.15	1.01			

TABLE 4.0 (cont'd)

		1986			1985			1984			1983		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
JUL	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.07	0.18	0.10	0.21	0.55	0.33			
	F Dos.	0.33	0.50	0.43	0.29	0.52	0.38	0.48	0.62	0.55			
	F Res.	0.94	1.08	1.00	0.97	1.09	1.03	0.92	1.08	0.98			
AUG	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.07	0.13	0.10	0.20	0.51	0.25			
	F Dos.	0.38	0.61	0.46	0.33	0.49	0.40	0.44	0.66	0.55			
	F Res.	0.95	1.12	1.03	0.95	1.07	1.01	0.93	1.06	0.99			
SEP	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.00	0.15	0.11	0.24	0.32	0.27			
	F Dos.	0.34	0.49	0.40	0.40	0.61	0.45	0.45	0.59	0.52			
	F Res.	0.96	1.08	1.02	0.93	1.12	1.03	0.93	1.04	0.98			
OCT	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.07	0.21	0.10	0.23	0.30	0.25			
	F Dos.	0.19	0.48	0.32	0.44	0.61	0.52	0.47	0.64	0.52			
	F Res.	0.96	1.10	1.05	0.93	1.07	0.99	0.88	1.07	1.00			
NOV	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.06	0.11	0.09	0.25	0.40	0.32			
	F Dos.	0.21	0.42	0.29	0.48	0.61	0.54	0.44	0.55	0.51			
	F Res.	0.92	1.06	1.01	0.87	1.07	1.01	0.95	1.09	1.01			
DEC	PAC												
	$KMnO_4$												
	Lime												
	$NaClO_2$				0.08	0.12	0.10	0.09	0.37	0.26			
	F Dos.	0.21	0.34	0.26	0.45	0.58	0.53	0.42	0.52	0.46			
	F Res.	0.95	1.07	1.02	0.97	1.06	1.01	0.91	1.13	1.01			

NOTE: Units used in this table are mg/L

TABLE 4.1

T & O CONTROL, ALKALINITY ADJ.
& FLUORIDATION PROFILE
(JANUARY,MAY, JULY, OCTOBER)/1984

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
JANUARY 1984
MOE WPOS PROTOCOL
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.36	0.39	1.01
2					0.41	0.45	1.03
3					0.40	0.43	1.00
4					0.38	0.43	0.97
5					0.40	0.48	0.92
6					0.38	0.43	0.94
7					0.38	0.43	0.94
8					0.38	0.43	0.92
9					0.39	0.44	0.95
10					0.40	0.44	0.96
11					0.37	0.46	0.94
12					0.40	0.44	0.94
13					0.34	0.41	0.92
14					0.39	0.41	0.92
15					0.39	0.43	0.94

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
16					0.40	0.46	0.97
17					0.42	0.47	0.97
18					0.36	0.43	0.97
19					0.36	0.44	0.95
20					0.40	0.45	0.94
21					0.36	0.43	0.97
22					0.39	0.44	0.91
23					0.40	0.46	0.90
24					0.43	0.50	0.96
25					0.38	0.46	0.95
26					0.39	0.44	0.95
27					0.42	0.48	0.94
28					0.39	0.47	0.95
29					0.39	0.47	0.93
30					0.42	0.51	0.91
31					0.41	0.49	1.03

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. &
FLUORIDATION PROFILE
MOE WPOS PROTOCOL

MAY 1984
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.26	0.58	0.95
2					0.44	0.54	1.08
3					0.40	0.58	0.94
4					0.32	0.55	0.97
5					0.36	0.60	0.91
6					0.35	0.58	0.99
7					0.38	0.59	0.97
8					0.32	0.54	0.98
9					0.32	0.58	0.98
10					0.28	0.58	1.09
11					0.34	0.60	1.07
12					0.32	0.50	1.03
13					0.36	0.52	1.09
14					0.36	0.52	0.97
15					0.39	0.55	1.01

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
16					0.29	0.48	0.98
17					0.31	0.54	1.02
18					0.33	0.59	1.00
19					0.36	0.50	0.99
20					0.55	0.54	0.99
21					0.41	0.52	0.98
22					0.55	0.48	0.98
23					0.33	0.53	0.99
24					0.28	0.54	1.02
25					0.27	0.55	0.99
26					0.28	0.61	1.02
27					0.33	0.52	1.01
28					0.29	0.50	0.93
29					0.31	0.51	0.96
30					0.28	0.54	0.94
31					0.23	0.59	0.98

TABLE 4.1: **T&O CONTROL, ALKALINITY ADJ. &**
FLUORIDATION PROFILE JULY 1984
MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
1					0.33	0.58	0.97
2					0.34	0.53	0.95
3					0.32	0.51	0.94
4					0.32	0.54	0.92
5					0.32	0.54	0.96
6					0.34	0.62	0.99
7					0.32	0.57	1.08
8					0.32	0.58	1.02
9					0.35	0.57	1.00
10					0.32	0.62	0.98
11					0.35	0.61	0.97
12					0.33	0.56	0.97
13					0.31	0.55	0.98
14					0.32	0.54	0.96
15					0.21	0.51	0.98

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16					0.27	0.52	1.01
17					0.25	0.52	1.05
18					0.23	0.51	0.99
19					0.27	0.55	1.00
20					0.27	0.55	1.02
21					0.24	0.52	0.99
22					0.25	0.49	0.98
23					0.24	0.50	0.99
24					0.23	0.48	0.98
25					0.25	0.53	1.03
26					0.27	0.50	0.96
27					0.25	0.53	0.99
28					0.23	0.52	1.06
29					0.28	0.52	1.03
30					0.30	0.57	0.88
31					0.28	0.64	1.03

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. &
FLUORIDATION PROFILE OCTOBER 1984
MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.25	0.49	0.98
2					0.28	0.56	1.00
3					0.27	0.56	0.99
4					0.25	0.50	1.02
5					0.27	0.50	1.01
6					0.26	0.49	0.97
7					0.23	0.51	1.07
8					0.23	0.52	0.97
9					0.25	0.46	NA
10					0.26	0.52	0.98
11					0.24	0.47	0.98
12					0.25	0.52	1.01
13					0.25	0.53	1.00
14					0.23	0.50	1.05
15					0.25	0.52	1.01

* NA - Data not available.

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16					0.37	0.52	0.97
17					0.39	0.54	0.96
18					0.33	0.53	1.00
19					0.32	0.50	0.95
20					0.31	0.52	1.00
21					0.31	0.52	1.02
22					0.35	0.62	0.95
23					0.31	0.57	1.01
24					0.29	0.53	0.96
25					0.28	0.50	1.00
26					0.36	0.57	1.08
27					0.34	0.52	1.02
28					0.30	0.47	1.03
29					0.37	0.52	0.98
30					0.33	0.52	1.03
31					0.37	0.55	1.02

TABLE 4.1

T & O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (JANUARY, MAY, JULY, OCTOBER)/1985

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

JANUARY 1985
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.05	0.46	1.15
2					0.10	0.46	1.04
3					0.09	0.44	0.96
4					0.06	0.45	0.96
5					0.08	0.46	1.06
6					0.09	0.43	1.04
7					0.10	0.45	1.07
8					0.10	0.47	1.02
9					0.11	0.46	1.00
10					0.10	0.48	1.07
11					0.10	0.41	1.09
12					0.10	0.43	1.08
13					0.09	0.46	1.06
14					0.09	0.46	1.06
15					0.08	0.45	0.93

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) JANUARY 1985

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16					0.09	0.46	1.09
17					0.09	0.41	1.10
18					0.08	0.39	1.02
19					0.10	0.41	0.99
20					0.11	0.36	1.07
21					0.08	0.36	0.93
22					0.08	0.39	0.94
23					0.08	0.44	0.91
24					0.07	0.42	1.04
25					0.08	0.44	0.94
26					0.07	0.42	0.99
27					0.06	0.40	0.96
28					0.06	0.42	0.94
29					0.10	0.45	0.90
30					0.13	0.48	0.99
31					0.09	0.39	0.98

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

MAY 1985
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.07	0.41	0.96
2					0.10	0.41	0.96
3					0.07	0.42	0.96
4					0.08	0.44	0.96
5					0.07	0.44	0.99
6					0.08	0.45	1.03
7					0.07	0.39	0.98
8					0.09	0.42	1.00
9					0.09	0.40	1.00
10					0.08	0.40	0.98
11					0.08	0.37	0.97
12					0.07	0.41	0.97
13					0.07	0.37	0.98
14					0.14	0.36	1.08
15					0.09	0.43	1.05

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) MAY 1985

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
16					0.08	0.37	0.99
17					0.07	0.39	0.98
18					0.08	0.35	0.97
19					0.11	0.36	0.95
20					0.08	0.36	0.98
21					0.08	0.43	1.03
22					0.08	0.41	1.06
23					0.05	0.32	1.10
24					0.08	0.32	1.06
25					0.06	0.33	1.03
26					0.06	0.38	1.07
27					0.05	0.35	1.01
28					0.06	0.38	1.01
29					0.07	0.39	1.08
30					0.06	0.38	**
31					0.09	0.38	1.03

** Data not available.

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

JULY 1985
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
1					0.10	0.41	1.02
2					0.09	0.43	1.03
3					0.10	0.42	1.06
4					0.09	0.38	1.00
5					0.10	0.40	0.99
6					0.10	0.43	1.00
7					0.12	0.52	1.04
8					0.10	0.39	1.08
9					0.10	0.42	1.01
10					0.10	0.42	1.02
11					0.10	0.42	1.01
12					0.08	0.48	1.05
13					0.08	0.41	1.08
14					0.18	0.46	1.06
15					0.11	0.40	1.09

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) JULY 1985

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16					0.10	0.37	1.03
17					0.10	0.35	1.01
18					0.09	0.29	1.06
19					0.09	0.33	1.05
20					0.10	0.30	1.03
21					0.10	0.33	1.05
22					0.09	0.33	1.03
23					0.09	0.34	0.97
24					0.07	0.33	0.99
25					0.10	0.33	1.00
26					0.08	0.33	1.01
27					0.10	0.33	1.00
28					0.08	0.34	1.00
29					0.08	0.33	1.01
30					0.07	0.34	0.98
31					0.14	0.41	1.05

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

OCTOBER 1985
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1					0.11	0.50	0.98
2					0.08	0.49	0.97
3					0.21	0.56	0.98
4					0.11	0.46	0.96
5					0.12	0.54	0.97
6					0.11	0.49	0.99
7					0.10	0.49	0.99
8					0.08	0.50	0.96
9					0.08	0.44	1.01
10					0.09	0.50	0.96
11					0.08	0.58	0.98
12					0.12	0.52	1.00
13					0.10	0.56	1.01
14					0.15	0.50	0.98
15					0.11	0.52	0.93

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) OCTOBER 1985

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16					0.11	0.51	0.94
17					0.07	0.46	0.96
18					0.13	0.51	0.97
19					0.13	0.55	0.98
20					0.11	0.49	0.97
21					0.10	0.47	0.99
22					0.07	0.49	0.97
23					0.09	0.58	0.95
24					0.08	0.61	1.03
25					0.10	0.58	1.07
26					0.08	0.54	1.01
27					0.09	0.58	1.04
28					0.08	0.52	1.07
29					0.09	0.53	1.03
30					0.10	0.50	0.97
31					0.09	0.45	1.01

TABLE 4.1

T & O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (JANUARY, MAY, JULY, OCTOBER)/1986

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

JANUARY 1986
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1						0.56	1.03
2						0.59	1.01
3						0.54	1.02
4						0.53	1.04
5						0.51	1.03
6						0.49	1.04
7						0.50	0.96
8						0.50	1.03
9						0.50	1.01
10						0.54	0.98
11						0.51	1.03
12						0.52	1.01
13						0.53	1.03
14						0.53	1.01
15						0.54	1.00

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) JANUARY 1986

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
16						0.53	0.99
17						0.46	1.00
18						0.45	1.00
19						0.49	0.98
20						0.45	0.99
21						0.44	1.00
22						0.46	0.98
23						0.42	0.99
24						0.45	0.97
25						0.51	1.01
26						0.45	0.97
27						0.53	0.94
28						0.56	0.97
29						0.55	0.98
30						0.56	1.00
31						0.62	0.97

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MAY 1986
MOE WPOS PROTOCOL
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
1						0.38	0.98
2						0.38	1.00
3						0.38	0.99
4						0.39	0.99
5						0.37	0.95
6						0.38	0.97
7						0.38	1.00
8						0.38	0.96
9						0.44	1.05
10						0.39	0.97
11						0.41	0.99
12						0.42	1.01
13						0.43	1.00
14						0.45	1.02
15						0.45	0.95

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) MAY 1986

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16						0.44	1.03
17						0.40	0.93
18						0.43	0.96
19						0.46	0.98
20						0.45	1.02
21						N.A.	N.A.
22						0.46	1.02
23						0.46	1.01
24						0.46	0.98
25						0.46	0.99
26						0.42	0.98
27						0.48	1.00
28						0.46	0.95
29						0.44	1.00
30						0.51	0.96
31						0.52	1.04

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. &
FLUORIDATION PROFILE
MOE WPOS PROTOCOL

JULY 1986
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1						0.45	0.97
2						0.45	0.99
3						0.43	0.96
4						0.43	0.96
5						0.46	0.96
6						0.44	0.98
7						0.44	0.99
8						0.44	1.00
9						0.42	0.98
10						0.37	1.05
11						0.39	1.06
12						0.42	1.04
13						0.46	0.98
14						0.42	0.99
15						0.42	1.02

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) JULY 1986

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
16						0.46	1.03
17						0.44	1.04
18						0.45	1.01
19						0.46	1.02
20						0.33	0.99
21						0.38	0.96
22						0.39	0.94
23						0.46	0.98
24						0.43	0.93
25						0.50	1.03
26						0.48	1.00
27						0.44	1.08
28						0.35	1.03
29						0.46	1.03
30						0.46	1.02
31						0.45	0.99

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE
MOE WPOS PROTOCOL

OCTOBER 1986
BURLINGTON WATER PURIFICATION PLANT

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE	
						Dosage	Residual
1						0.36	1.02
2						0.41	1.03
3						0.37	1.08
4						0.30	1.07
5						0.29	1.10
6						0.26	1.07
7						0.25	1.06
8						0.25	1.06
9						0.25	1.02
10						0.32	1.07
11						0.32	1.09
12						0.32	1.05
13						0.24	1.05
14						0.20	1.08
15						0.19	1.05

TABLE 4.1: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION PROFILE (cont'd) OCTOBER 1986

DATE	PAC	$KMnO_4$	LIME	SODA ASH	$NaClO_2$	FLUORIDE Dosage	FLUORIDE Residual
16						0.32	0.96
17						0.48	1.06
18						0.37	1.07
19						0.39	1.06
20						0.33	1.02
21						0.37	1.03
22						0.36	1.01
23						0.35	1.02
24						0.36	1.02
25						0.35	0.99
26						0.38	1.02
27						0.37	1.08
28						0.35	1.06
29						0.32	1.05
30						0.32	1.05
31						0.30	1.01

TABLE 5.0

WATER QUALITY 1-YEAR SUMMARY 1986

TABLE 5.0

WMOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

GENERAL CHEMISTRY		1 9 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
GENERAL CHEMISTRY															
ALKALINITY	R	96.8	97.8	99.0	103.3		99.4	98.7	--	93.3				0.2	
mg/L	T	92.5	93.6	94.2	98.4		89.6	95.1	89.4	92.0				mg/L	
AMMONIUM TOTAL	R	<0.05	<.05	<.05	<.05		<.05	1.05	--	<.05				0.05	
mg/L	T	<0.05	<.05	<.05	<.05		<.05	<.05	<.05	<.05				mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	26.3	26.4	26.25	27.35		27.70	28.30	--	24.3				0.2	250
mg/L	T	26.2	27.2	30.55	28.55		28.40	32.40	25.8	26.2				mg/L	mg/L
COLOUR TCU	R	2.75	6.0	<0.5	3.0		3.0	3.0	--	2.5				0.5	5
	T	<0.5	0.5	<0.5	0.5		1.0	1.5	1.0	1.0				TCU	TCU
CONDUCTIVITY	R	330	339	334	338		335	343	--	311				0.01	
umho/cm	T	333	339	344	339		339	359	316	315				UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

GENERAL CHEMISTRY (Cont'd)		19 86 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R	0.135	0.14	0.15	0.12		0.17	0.17	--	0.14				0.01	2.4
mg/L	T	0.99	0.73	0.94	1.04		1.06	1.00	1.12	0.89				mg/L	mg/L
HARDNESS	R	132	135	134.5	137.5		135.0	136	--	125.5				0.5	
mg/L	T	131	137	136.5	137.5		134.0	139.5	130.0	127.5				mg/L	
MAGNESIUM	R	8.43	8.5	8.4	8.75		8.50	8.85	--	8.10				0.05	
mg/L	T	8.45	8.6	8.35	8.75		8.35	8.95	8.40	8.20				mg/L	c
NITRATE	R	0.375	0.25	0.40	0.35		0.20	0.40	--	0.25				0.05	10 mg/L
mg/L	T	0.35	0.20	0.35	0.30		0.20	0.45	0.20	0.30				mg/L	as N
NITRITE	R	< .005	< .005	0.10	.015		.010	.005	--	.005				0.005	1 mg/L
mg/L	T	< .005	< .005	< .005	< .005		< .005	< .005	< .005	.005				mg/L	as N
NITROGEN TOTAL KJELDAHL	R	0.25	0.30	0.20	0.40		0.20	0.20	--	0.40				0.1	0.15
mg/L	T	0.20	0.30	< 0.20	0.20		0.20	< .20	0.20	0.40				mg/L	mg/L *
PH	R	8.13	7.86	8.24	8.38		8.37	8.36	--	8.26					
	T	7.65	7.59	7.86	8.20		7.98	8.00	8.04	8.25					
PHOSPHORUS FILTERED REACTIVE	R	< 0.01	< .01	< .01	.03		< .01	.04	--	< .01				0.01	
mg/L	T	< 0.01	< .01	< .01	.04		< .01	< .01	--	< .01				mg/L	

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

GENERAL CHEMISTRY (Cont'd)		1 9 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
PHOSPHORUS TOTAL	R	0.02	0.02	0.04	0.04		< .02	< .02	--	0.02				0.01	
mg/L	T	0.01	0.02	0.02	0.02		< .02	< .02	0.02	0.02				mg/L	
SODIUM	R	13.0	14.5	14.2	14.7		14.5	13.5	---	12.3				0.1	
mg/L	T	12.75	14.0	14.9	14.8		14.0	14.8	12.4	12.6				mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	1.21	4.60	2.5	2.0		1.70	1.08	---	1.07				0.01	1
FTU	T	0.12	0.14	0.42	0.28		0.78	0.70	0.36	0.35				FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

METALS (Cont'd)			19 86 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
CHROMIUM		R													0.001	0.05
	mg/L	T													mg/L	mg/L
COBALT		R													0.001	
	mg/L	T													mg/L	
COPPER		R													0.001	1
	mg/L	T													mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R	0.054	0.16	0.044	0.049		0.032	0.041	---	.027	0.013			0.002	0.3
	mg/L	T	0.017	0.021	0.044	0.041		0.012	0.030	---	.028	0.019			mg/L	mg/L c
LEAD	mg/L	R													0.003	0.05
		T													mg/L	mg/L
MANGANESE		R													0.001	0.05
	mg/L	T													mg/L	mg/L
MOLYBDENUM		R													0.001	
	mg/L	T													mg/L	
MERCURY		R													0.01	1
	ug/L	T													ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

METALS (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R													0.001	
mg/L	T													mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R													0.001	
mg/L	T													mg/L	
ZINC	R													0.001	5
mg/L	T													mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

PURGEABLES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
CHLORODIBROMOMETHANE	R	0	0	0.6	0	0.5	1	0	0	0	0			1	350
ug/L	T	6.3	5.5	6.7	6.8	6.5	8.0	6.5	5.0	6.0	6.7			ug/L	ug/L ++
CHLOROFORM	R	0	0	0	0	6	1	0	0	0	0			1	350
ug/L	T	16.6	14	22	19.5	22.5	14.3	15.3	14.5	15.7	32.0			ug/L	ug/L ++
1,2-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,3-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,4-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
DICHLOROBROMOMETHANE	R	0	0	0.3	0	1.8	1.3	0	0	0	0			1	350
ug/L	T	13.8	10.5	12.7	12.8	11.5	15.3	13.3	8.0	20.3	16.7			ug/L	ug/L ++
1,1-DICHLOROETHANE	R													1	
ug/L	T													ug/L	
1,2-DICHLOROETHANE	R													1	10
ug/L	T													ug/L	ug/L h
1,1-DICHLOROETHYLENE	R													1	.3
ug/L	T													ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R													1	
ug/L	T													ug/L	

APP

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

PURGEABLES (Cont'd)		1 9 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
DICHLOROMETHANE	R													5	40
ug/L	T													ug/L	ug/L c
1,2 DICHLOROPROPANE	R													1	
ug/L	T													ug/L	
ETHYLBENZENE	R													1	1400
ug/L	T													ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
O-XYLENE	R													1 ug/L	620
ug/L	T														ug/L c
P-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
TOLUENE	R													1	100
ug/L	T													ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R													1	1.7
ug/L	T													ug/L	ug/L e
TETRACHLOROETHYLENE	R													1	10
ug/L	T													ug/L	ug/L h

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

PURGEABLES (Cont'd)		19												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
1,1,1-TRICHLOROETHANE	R													1	1000
ug/L	T													ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R													1	6
ug/L	T													ug/L	ug/L e
TRICHLOROETHYLENE	R													1	30
ug/L	T													ug/L	ug/L h
TOTAL TRIHALOMETHANES	R	0	0	1	0	8.3	3.3	0	0	0	0			3	350
ug/L	T	37	30	42	38.5	40.5	34.3	35.5	27.5	42.0	55.0			ug/L	ug/L ++
TRIFLUOROCHLOROTOLUENE	R													1	
ug/L	T													ug/L	
ORGANOCHLORINES															
ALDRIN	R			< 1				< 1		< 1				1	700
ng/L	T			< 1				< 1		< 1				ng/L	ng/L **
ALPHA BHC	R			3				3		2				1	700
ng/L	T			3				2		2				ng/L	ng/L c
ALPHA CHLORDANE	R			< 2				< 2		< 2				2	700
ng/L	T			< 2				< 2		< 2				ng/L	ng/L ***
BETA BHC	R			< 1				< 1		< 1				1	300
ng/L	T			< 1				< 1		< 1				ng/L	ng/L c
DIELDRIN	R			< 2				< 2		< 2				2	700
ng/L	T			< 2				< 2		< 2				ng/L	ng/L **

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY – 1-YEAR SUMMARY (1986)

ORGANOCHLORINES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
ENDRIN	R			< 4				< 4		< 4				4	200
ng/L	T			< 4				< 4		< 4				ng/L	ng/L
GAMMA CHLORDANE	R			< 2				< 2		< 2				2	700
ng/L	T			< 2				< 2		< 2				ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R			< 1				< 1		< 1				1	3000 +++
ng/L	T			< 1				< 1		< 1				ng/L	ng/L
HEPTACHLOR	R			< 1				< 1		< 1				1	3000
ng/L	T			< 1				< 1		< 1				ng/L	ng/L +++
HEXACHLOROBENZENE	R			< 1				< 1		< 1				1	10
ng/L	T			< 1				< 1		< 1				ng/L	ng/L h
HEXACHLOROBUTADIENE	R			< 1				< 1		< 1					
ug/L	T			< 1				< 1		< 1					
HEXACHLOROETHANE	R			< 1				< 1		< 1				1	19000
ng/L	T			< 1				< 1		< 1				ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R			< 5				< 5		< 5				5	100000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L
MIREX	R			< 5				< 5		< 5				5	
ng/L	T			< 5				< 5		< 5				ng/L	

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

ORGANOCHLORINES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
OCTACHLOROSTYRENE	R			< 1				< 1		< 1				1	
ng/L	T			< 1				< 1		< 1				ng/L	
O,P-DDT	R			< 5				< 5		< 5				5	30000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L d
OXYCHLORDANE	R			< 2				< 2		< 2				2	
ng/L	T			< 2				< 2		< 2				ng/L	
PCB TOTAL	R			< 20				< 20		< 20				20	3000
ng/L	T			< 20				< 20		< 20				ng/L	ng/L t
PENTACHLOROBENZENE	R			< 1				< 1		< 1				1	74000
ng/L	T			< 1				< 1		< 1				ng/L	ng/L e
P,P-DDD	R			< 5				< 5		< 5				5	d
ng/L	T			< 5				< 5		< 5				ng/L	
P,P-DDE	R			< 1				< 1		< 1				1	d
ng/L	T			< 1				< 1		< 1				ng/L	
P,P-DDT	R			< 5				< 5		< 5				5	d
ng/L	T			< 5				< 5		< 5				ng/L	
1,2,3,4-TETRACHLOROBENZENE	R			< 1				< 1		< 1				1	
ng/L	T			< 1				< 1		< 1				ng/L	
1,2,3,5-TETRACHLOROBENZENE	R			< 1				< 1		< 1				1	
ng/L	T			< 1				< 1		< 1				ng/L	

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

ORGANOCHLORINES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
1,2,4,5-TETRACHLOROBENZENE	R			< 1				< 1		< 1				1	38000
ng/L	T			< 1				< 1		< 1				ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R			< 5				< 5		< 5				5	10000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R			< 5				< 5		< 5				5	15000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R			< 5				< 5		< 5				5	10000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R			< 5				< 5		< 5				5	
ng/L	T			< 5				< 5		< 5				ng/L	
2,4,5-TRICHLOROTOLUENE	R			< 5				< 5		< 5				5	10000
ng/L	T			< 5				< 5		< 5				ng/L	ng/L g

ORGANOCHLORINES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
2,6,A-TRICHLOROTOLUENE	R			< 5				< 5		< 5				5	
mg/L	T			< 5				< 5		< 5				ng/L	
TRIAZINES															
ALACHLOR	R														
ng/L	T														
AMETRINE	R													50	
ng/L	T													ng/L	
ATRATONE	R														
ng/L	T														
ATRAZINE	R													50	46000
ng/L	T													ng/L	ng/L !
BLADEX	R													100	10000
ng/L	T													ng/L	ng/L !
METOLACHLOR	R														
ng/L	T														
PROMETONE	R													50	
ng/L	T													ng/L	
PROMETRYNE	R													50	1000
ng/L	T													ng/L	ng/L !
PROPAZINE	R													50	
ng/L	T													ng/L	

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

SPECIAL PESTICIDES (Cont'd)		19 86 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L e

APP-

TABLE 5.0

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1986 **)**

MASS SPEC. (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
N-DICHLOROMETHYLENE- PENTACHLOROANALINE	R													0.1 ug/L	
ug/L	T														
DIPHENYL ETHER	R													0.1	
ug/L	T													ug/L	
FLUORANTHENE	R													0.1	
ug/L	T													ug/L	
HEXACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
METHYL PHENANTHRENE	R													0.1	
ug/L	T													ug/L	
NAPHTHALENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROBUTADIENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPANE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
PYRENE	R													0.1	
ug/L	T													ug/L	

TABLE 5.0

MPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

MASS SPEC. (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	179	243	87	2	28	16	332	28	39	21	10			
TOTAL COLIFORM BKGD count/mL	R	334	855	152	40	183	168	749	261	269	268	57			
FECAL COLIFORM MF count/100mL	R	< 2	9	< 2	< 2	< 2	1	11	5	3	2	< 2		0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R													0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	A	A	A	P	A	A	A	A	A	A	A			
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0		0	OWDO Bact!

TABLE 5.0

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1986)

BACTERIA (Cont'd)		19 86												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0		0	ODWO Bact I
STANDARD PLATE COUNT MF count/100mL	T														
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T				A										
FECAL COLIFORM P/A	T				A										
E. COLI P/A	T				A										
AROMONAS P/A	T				A										
STAPH. AUREUS P/A	T				A										

A0107A/eal

TABLE 5.1

WATER QUALITY 1-YEAR SUMMARY 1985

TABLE 5.1
WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1985 **)**

Page 1

GENERAL CHEMISTRY		1 9 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
GENERAL CHEMISTRY															
ALKALINITY	R	95.0		97.6		98.1		96.8	91.8	97.2	95.4	94.4	NA	0.2	
mg/L	T	92.0		94.0		94.6		92.9	88.6	92.8	90.2	89.0	90.4	mg/L	
AMMONIUM TOTAL	R	<.05		<.05		0.05		<.05	<.05	<.05	<.05	<.05	NA	0.05	
mg/L	T	<.05		<.05		<.05		<.05	<.05	<.05	<.05	<.05	<.05	mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	25.6		26.9		25.7		25.8	22.8	25.2	24.4	22.8	NA	0.2	250
mg/L	T	25.0		29.3		27.1		27.0	24.2	26.4	25.2	24.4	26.0	mg/L	mg/L
COLOUR TCU	R	2.0		4.75		3.25		3.50	3.0	2.5	2.5	2.0	NA	0.5	5
	T	0.5		1.50		1.75		1.75	< 2.0	< .05	0.5	< 0.5	< 0.5	TCU	TCU
CONDUCTIVITY	R	327		338		335		324	312	329	322	320	NA	0.01	
umho/cm	T	330		347		336		328	318	329	326	324	333	UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

NA - data not available

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

GENERAL CHEMISTRY (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R	0.14		0.16		0.12		0.16	0.15	0.14	0.14	0.14	NA	0.01	2.4
mg/L	T	0.86		0.93		0.78		0.77	0.78	1.01	0.80	1.06	0.90	mg/L	mg/L
HARDNESS	R	130.8		131.6		129.5		128.0	125.5	132.0	130.0	126.0	NA	0.5	
mg/L	T	130.7		132.2		129.5		128.5	126.6	133.0	129.0	128.0	132.0	mg/L	
MAGNESIUM	R	8.05		8.25		8.48		8.25	8.40	8.30	8.30	8.20	NA	0.05	
mg/L	T	8.10		8.30		8.33		8.38	8.30	8.30	8.45	8.35	8.40	mg/L	
NITRATE	R	0.35		0.55		0.48		0.30	0.25	0.40	0.25	0.25	NA	0.05	10 mg/L
mg/L	T	0.35		0.45		0.40		0.30	<.05	0.40	0.20	0.30	0.30	mg/L	as N
NITRITE	R	<.005		0.015		<.005		0.01	<.005	<.005	0.01	<.005	NA	0.005	1 mg/L
mg/L	T	<.005		<.005		<.005		<.005	<.005	<.005	<.005	<.005	<.005	mg/L	as N
NITROGEN TOTAL KJELDAHL	R	0.20		0.30		0.30		0.35	0.30	0.30	0.30	0.30	NA	0.1	0.15
mg/L	T	0.30		0.20		0.30		0.25	0.40	0.30	0.20	0.20	0.20	mg/L	mg/L *
PH	R	8.14		8.11		8.43		8.48	8.18	7.87	8.24	8.00	NA		
	T	7.83		7.70		8.04		7.98	7.75	7.59	7.76	7.57	7.78		
PHOSPHORUS FILTERED REACTIVE	R	<.01		<.01		<.01		<.01	<.01	<.01	<.01	<.01	NA	0.01	
mg/L	T	<.01		<.01		<.01		<.01	<.01	<.01	<.01	<.01	<.01	mg/L	

NA - data not available

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

GENERAL CHEMISTRY (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
PHOSPHORUS TOTAL	R	0.02		0.06		0.01		<.01	0.02	0.02	<.01	0.02	NA	0.01	
mg/L	T	0.02		0.05		0.01		0.02	0.02	0.02	<.01	<.01	0.02	mg/L	
SODIUM	R	12.8		13.6		13.9		13.0	11.6	13.0	12.6	12.5	NA	0.1	
mg/L	T	12.5		14.2		13.8		12.9	12.0	12.6	12.5	12.5	13.2	mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	0.57		6.6		1.25		0.90	1.92	0.71	0.91	1.76	NA	0.01	1
FTU	T	0.05		0.32		0.29		0.35	0.21	0.16	0.24	0.13	0.12	FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

NA - data not available

WPOS

PLANT BURLINGTON WATER QUALITY – 1-YEAR SUMMARY (1985)

METALS (Cont'd)			19 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHROMIUM		R													0.001	0.05
	mg/L	T													mg/L	mg/L
COBALT		R													0.001	
	mg/L	T													mg/L	
COPPER		R													0.001	1
	mg/L	T													mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R	0.03		0.31		0.04		0.01	.030	.017	.013	.089	.012	0.002	0.3
	mg/L	T	0.01		0.01		0.01		0.06	<.005	.009	<.005	.013	.053	mg/L	mg/L c
LEAD	mg/L	R													0.003	0.05
		T													mg/L	mg/L
MANGANESE		R													0.001	0.05
	mg/L	T													mg/L	mg/L
MOLYBDENUM		R													0.001	
	mg/L	T													mg/L	
MERCURY		R													0.01	1
	ug/L	T													ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1985 **)**

METALS (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R													0.001	
mg/L	T													mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R													0.001	
mg/L	T													mg/L	
ZINC	R													0.001	5
mg/L	T													mg/L	mg/L h
PURGEABLES															
BENZENE	R	0			0									1	10
ug/L	T	0			0									ug/L	ug/L h
BROMOFORM	R	0			0									1	350
ug/L	T	2			2									ug/L	ug/L ++
CARBON TETRACHLORIDE	R	0			0									1	3
ug/L	T	0			0									ug/L	ug/L h
CHLOROBENZENE	R	0			0									1	100-300
ug/L	T	0			0									ng/L	ng/L h*

MPOS

PLANT : BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR.	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
CHLORODIBROMOMETHANE	R	0		0	0	0		0	0	0	0	0	0	1	350
ug/L	T	7		2	6	0		5	5	5	5	5	7	ug/L	ug/L ++
CHLOROFORM	R	0		0	0	0		0	0	0	0	0	0	1	350
ug/L	T	12		7	10	1		9	24	23	11	21	17	ug/L	ug/L ++
1,2-DICHLOROBENZENE	R	0			0									1	400
ug/L	T	0			0									ug/L	ug/L e
1,3-DICHLOROBENZENE	R	0			0									1	400
ug/L	T	0			0									ug/L	ug/L e
1,4-DICHLOROBENZENE	R	0			0									1	400
ug/L	T	0			0									ug/L	ug/L e
DICHLOROBROMOMETHANE	R	0		0	0	0		0	0	0	0	0	0	1	350
ug/L	T	10		5	9	1		7	12	18	11	14	12	ug/L	ug/L ++
1,1-DICHLOROETHANE	R	0			0									1	
ug/L	T	0			0									ug/L	
1,2-DICHLOROETHANE	R	0			0									1	10
ug/L	T	0			0									ug/L	ug/L h
1,1-DICHLOROETHYLENE	R	0			0									1	.3
ug/L	T	0			0									ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R	0			0									1	
ug/L	T	0			0									ug/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		1 9 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
DICHLOROMETHANE	R	0			0									5	40
ug/L	T	0			0									ug/L	ug/L c
1,2 DICHLOROPROPANE	R	0			0									1	
ug/L	T	0			0									ug/L	
ETHYLBENZENE	R	0			0									1	1400
ug/L	T	0			0									ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R	0			0									1	620
ug/L	T	0			0									ug/L	ug/L c
O-XYLENE	R	0			0									1 ug/L	620
ug/L	T	0			0										ug/L c
P-XYLENE	R	0			0									1	620
ug/L	T	0			0									ug/L	ug/L c
TOLUENE	R	0			0									1	100
ug/L	T	0			0									ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R	0			0									1	1.7
ug/L	T	0			0									ug/L	ug/L e
TETRACHLOROETHYLENE	R	0			0									1	10
ug/L	T	0			0									ug/L	ug/L h

WPOS

PLANT BURLINGTON WATER QUALITY – 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		19 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
1,1,1-TRICHLOROETHANE	R	0			0									1	1000
ug/L	T	0			0									ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R	0			0									1	6
ug/L	T	0			0									ug/L	ug/L e
TRICHLOROETHYLENE	R	0			0									1	30
ug/L	T	0			0									ug/L	ug/L h
TOTAL TRIHALOMETHANES	R	0		0	0	0		0	0	0	0	0	0	3	350
ug/L	T	10		14	26	2		20	41	48	27	39	36	ug/L	ug/L **
TRIFLUOROCHLOROTOLUENE	R	0			0									1	
ug/L	T	0			0									ug/L	
ORGANOCHLORINES															
ALDRIN	R	<1							<1	<1			<1	1	700
ng/L	T	<1							<1	<1			<1	ng/L	ng/L **
ALPHA BHC	R	5							<1	2			3	1	700
ng/L	T	6							<1	3			4	ng/L	ng/L c
ALPHA CHLORDANE	R	<2							<2	<2			<2	2	700
ng/L	T	<2							<2	<2			<2	ng/L	ng/L ***
BETA BHC	R	<1							<1	<1			<1	1	300
ng/L	T	<1							<1	2			<1	ng/L	ng/L c
DIELDRIN	R	<2							<2	<2			<2	2	700
ng/L	T	<2							<2	<2			<2	ng/L	ng/L **

MOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
ENDRIN	R	< 4							< 4	< 4			< 4	4	200
ng/L	T	< 4							< 4	< 4			< 4	ng/L	ng/L
GAMMA CHLORDANE	R	< 2							< 2	< 2			< 2	2	700
ng/L	T	< 2							< 2	< 2			< 2	ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R	< 1							< 1	< 1			< 1	1	3000 ***
ng/L	T	< 1							< 1	< 1			< 1	ng/L	ng/L
HEPTACHLOR	R	< 1							< 1	< 1			< 1	1	3000
ng/L	T	< 1							< 1	< 1			< 1	ng/L	ng/L ***
HEXACHLOROBENZENE	R	< 1							< 1	< 1			< 1	1	10
ng/L	T	< 1							< 1	< 1			< 1	ng/L	ng/L h
HEXACHLOROBUTADIENE	R	< 1							< 1	< 1			< 1		
ug/L	T	1							< 1	< 1			< 1		
HEXACHLOROETHANE	R	< 1							< 1	< 1			< 1	1	19000
ng/L	T	3							< 1	< 1			< 1	ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R	< 5							< 5	< 5			< 5	5	100000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L
MIREX	R	< 5							< 5	< 5			< 5	5	
ng/L	T	< 5							< 5	< 5			< 5	ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
OCTACHLOROSTYRENE	R	< 1							< 1	< 1			< 1	1	
ng/L	T	< 1							< 1	< 1			< 1	ng/L	
O,P-DDT	R	< 5							< 5	< 5			< 5	5	30000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L d
OXYCHLORDANE	R	< 2							< 2	< 2			< 2	2	
ng/L	T	< 2							< 2	< 2			< 2	ng/L	
PCB TOTAL	R	< 20							< 20	< 20			< 20	20	3000
ng/L	T	< 20							< 20	< 20			< 20	ng/L	ng/L t
PENTACHLOROBENZENE	R	< 1							< 1	< 1			< 1	1	74000
ng/L	T	< 1							< 1	< 1			< 1	ng/L	ng/L e
P,P-DDD	R	< 5							< 5	< 5			< 5	5	d
ng/L	T	< 5							< 5	< 5			< 5	ng/L	
P,P-DDE	R	< 1							NA	< 1			< 1	1	d
ng/L	T	< 1							NA	< 1			< 1	ng/L	
P,P-DDT	R	< 5							< 5	< 5			< 5	5	d
ng/L	T	< 5							< 5	< 5			< 5	ng/L	
1,2,3,4-TETRACHLOROBENZENE	R	< 1							< 1	< 1			< 1	1	
ng/L	T	< 1							< 1	< 1			< 1	ng/L	
1,2,3,5-TETRACHLOROBENZENE	R	< 1							< 1	< 1			< 1	1	
ng/L	T	< 1							< 1	< 1			< 1	ng/L	

NA -- Data not available.

MPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		1 9 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
1,2,4,5-TETRACHLOROBENZENE	R	< 1							< 1	< 1			< 1	1	38000
ng/L	T	< 1							< 1	17			< 1	ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R	< 5							< 5	< 5			< 5	5	10000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R	< 5							< 5	< 5			< 5	5	15000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R	< 5							< 5	< 5			< 5	5	10000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R	< 5							< 5	< 5			< 5	5	
ng/L	T	< 5							< 5	5			< 5	ng/L	
2,4,5-TRICHLOROTOLUENE	R	< 5							< 5	< 5			< 5	5	10000
ng/L	T	< 5							< 5	< 5			< 5	ng/L	ng/L g

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		1985												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
2,6,A-TRICHLOROTOLUENE	R	< 5							< 5	< 5			< 5	5	
mg/L	T	< 5							< 5	< 5			< 5	ng/L	
TRIAZINES															
ALACHLOR	R														
ng/L	T														
AMETRINE	R													50	
ng/L	T													ng/L	
ATRATONE	R														
ng/L	T														
ATRAZINE	R													50	46000
ng/L	T													ng/L	ng/L 1
BLADEX	R													100	10000
ng/L	T													ng/L	ng/L 1
METOLACHLOR	R														
ng/L	T														
PROMETONE	R													50	
ng/L	T													ng/L	
PROMETRYNE	R													50	1000
ng/L	T													ng/L	ng/L 1
PROPAZINE	R													50	
ng/L	T													ng/L	

MPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1985 **)**

TRIAZINES (Cont'd)		1985												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L I
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L I
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L I
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

SPECIAL PESTICIDES (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		1 9 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYL-TRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

MASS SPEC. (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
N-DICHLOROMETHYLENE-PENTACHLOROANALINE	R													0.1	
ug/L	T													ug/L	
DIPHENYL ETHER	R													0.1	
ug/L	T													ug/L	
FLUORANTHENE	R													0.1	
ug/L	T													ug/L	
HEXACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
METHYL PHENANTHRENE	R													0.1	
ug/L	T													ug/L	
NAPHTHALENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROBUTADIENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPANE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
PYRENE	R													0.1	
ug/L	T													ug/L	

MPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

MASS SPEC. (Cont'd)		1 9 85 JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	309	17	38	28	16	11	295	79	28	35	943	38		
TOTAL COLIFORM BKGD count/mL	R	1247	74	107	226	129	142	698	>5000	1428	412	2530	200		
FECAL COLIFORM MF count/100mL	R	25	<2	< 2	< 2	< 2	< 2	23	12	12	2	116	2	0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R													0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	A	A	A	A	A	A	A	A	A	A	A	A		
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0	0	0	OWDO Bact!

WTOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1985)

BACTERIA (Cont'd)		19 85												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0	0	0	ODWO Bactl
STANDARD PLATE COUNT MF count/100mL	T														
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T														
FECAL COLIFORM P/A	T														
E. COLI P/A	T														
AROMONAS P/A	T														
STAPH. AUREUS P/A	T														

TABLE 5.2

WATER QUALITY 1-YEAR SUMMARY 1984

TABLE 5.2

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1984 **)**

GENERAL CHEMISTRY		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
GENERAL CHEMISTRY															
ALKALINITY	R		99.0				95.4							0.2	
mg/L	T		93.4				90.6							mg/L	
AMMONIUM TOTAL	R		<0.1				<.05							0.05	
mg/L	T		<0.1				<.05							mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R		28.6				26.6							0.2	250
mg/L	T		29.8				28.2							mg/L	mg/L
COLOUR TCU	R		8.0				3.0							0.5	5
	T		3.5				1.5							TCU	TCU
CONDUCTIVITY	R		347				320							0.01	
umho/cm	T		354				328							UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1984 **)**

GENERAL CHEMISTRY (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		1 9 84													
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R		0.14				0.15							0.01	2.4
mg/L	T		0.98				1.04							mg/L	mg/L
HARDNESS	R		138.7				132.8							0.5	
mg/L	T		138.1				133.2							mg/L	
MAGNESIUM	R		9.0				8.9							0.05	
mg/L	T		9.1				8.7							mg/L	c
NITRATE	R		0.5				<.05							0.05	10 mg/L
mg/L	T		0.4				<.05							mg/L	as N
NITRITE	R		0.01				0.01							0.005	1 mg/L
mg/L	T		0.01				<.005							mg/L	as N
NITROGEN TOTAL KJELDAHL	R		0.6				0.3							0.1	0.15
mg/L	T		0.2				0.4							mg/L	mg/L *
PH	R		8.04				8.66								
	T		7.84				7.64								
PHOSPHORUS FILTERED REACTIVE	R		<.02				<.01							0.01	
mg/L	T		0.02				<.01							mg/L	

MPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

GENERAL CHEMISTRY (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
PHOSPHORUS TOTAL	R		0.08				0.06							0.01	
mg/L	T		0.01				0.05							mg/L	
SODIUM	R		15.5				13.6							0.1	
mg/L	T		16.0				13.5							mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R		31.0				1.72							0.01	1
FTU	T		0.35				1.26							FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

MPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

METALS (Cont'd)			19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
			JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
CHROMIUM		R													0.001	0.05
	mg/L	T													mg/L	mg/L
COBALT		R													0.001	
	mg/L	T													mg/L	
COPPER		R													0.001	1
	mg/L	T													mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R		1.45				0.06							0.002	0.3
	mg/L	T		<0.01				0.03							mg/L	mg/L c
LEAD	mg/L	R													0.003	0.05
		T													mg/L	mg/L
MANGANESE		R													0.001	0.05
	mg/L	T													mg/L	mg/L
MOLYBDENUM		R													0.001	
	mg/L	T													mg/L	
MERCURY		R													0.01	1
	ug/L	T													ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

METALS (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R													0.001	
mg/L	T													mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R													0.001	
mg/L	T													mg/L	
ZINC	R													0.001	5
mg/L	T													mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L **
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

WPOS

PLANT BURLINGTON · WATER QUALITY - 1-YEAR SUMMARY (1984)

PURGEABLES (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
CHLORODIBROMOMETHANE	R					0	0					0	0	1	350
ug/L	T					3	0					3	2	ug/L	ug/L ++
CHLOROFORM	R					0	0					0	0	1	350
ug/L	T					6	0					8	6	ug/L	ug/L ++
1,2-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,3-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,4-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
DICHLOROBROMOMETHANE	R					0	0					0	0	1	350
ug/L	T					5	2					6	4	ug/L	ug/L ++
1,1-DICHLOROETHANE	R													1	
ug/L	T													ug/L	
1,2-DICHLOROETHANE	R													1	10
ug/L	T													ug/L	ug/L h
1,1-DICHLOROETHYLENE	R													1	.3
ug/L	T													ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R													1	
ug/L	T													ug/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

PURGEABLES (Cont'd)		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
DICHLOROMETHANE	R													5	40
ug/L	T													ug/L	ug/L c
1,2 DICHLOROPROPANE	R													1	
ug/L	T													ug/L	
ETHYLBENZENE	R													1	1400
ug/L	T													ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
O-XYLENE	R													1 ug/L	620
ug/L	T														ug/L c
P-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
TOLUENE	R													1	100
ug/L	T													ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R													1	1.7
ug/L	T													ug/L	ug/L e
TETRACHLOROETHYLENE	R													1	10
ug/L	T													ug/L	ug/L h

WPOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1984 **)**

PURGEABLES (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
1,1,1-TRICHLOROETHANE	R													1	1000
ug/L	T													ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R													1	6
ug/L	T													ug/L	ug/L e
TRICHLOROETHYLENE	R													1	30
ug/L	T													ug/L	ug/L h
TOTAL TRIHALOMETHANES	R											0	0	3	350
ug/L	T											17	12	ug/L	ug/L **
TRIFLUOROCHLOROTOLUENE	R													1	
ug/L	T													ug/L	
ORGANOCHLORINES															
ALDRIN	R													1	700
ng/L	T													ng/L	ng/L **
ALPHA BHC	R													1	700
ng/L	T													ng/L	ng/L c
ALPHA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
BETA BHC	R													1	300
ng/L	T													ng/L	ng/L c
DIELDRIN	R													2	700
ng/L	T													ng/L	ng/L **

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

ORGANOCHLORINES (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		19 84													
ENDRIN	R													4	200
ng/L	T													ng/L	ng/L
GAMMA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R													1	3000 +++
ng/L	T													ng/L	ng/L
HEPTACHLOR	R													1	3000
ng/L	T													ng/L	ng/L +++
HEXACHLOROBENZENE	R													1	10
ng/L	T													ng/L	ng/L h
HEXACHLOROBUTADIENE	R														
ug/L	T														
HEXACHLOROETHANE	R													1	19000
ng/L	T													ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R													5	100000
ng/L	T													ng/L	ng/L
MIREX	R													5	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY – 1-YEAR SUMMARY (1984)

ORGANOCHLORINES (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
OCTACHLOROSTYRENE	R													1	
ng/L	T													ng/L	
O,P-DDT	R													5	30000
ng/L	T													ng/L •	ng/L d
OXYCHLORDANE	R													2	
ng/L	T													ng/L	
PCB TOTAL	R													20	3000
ng/L	T													ng/L	ng/L t
PENTACHLOROBENZENE	R													1	74000
ng/L	T													ng/L	ng/L e
P,P-DDD	R													5	d
ng/L	T													ng/L	
P,P-DDE	R													1	d
ng/L	T													ng/L	
P,P-DDT	R													5	d
ng/L	T													ng/L	
1,2,3,4-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	
1,2,3,5-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

ORGANOCHLORINES (Cont'd)		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
1,2,4,5-TETRACHLOROBENZENE	R													1	38000
ng/L	T													ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R													5	15000
ng/L	T													ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R													5	
ng/L	T													ng/L	
2,4,5-TRICHLOROTOLUENE	R													5	10000
ng/L	T													ng/L	ng/L g

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

ORGANOCHLORINES (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
2,6,A-TRICHLOROTOLUENE	R													5	
mg/L	T													ng/L	
TRIAZINES															
ALACHLOR	R														
ng/L	T														
AMETRINE	R													50	
ng/L	T													ng/L	
ATRATONE	R														
ng/L	T														
ATRAZINE	R													50	46000
ng/L	T													ng/L	ng/L [1]
BLADEX	R													100	10000
ng/L	T													ng/L	ng/L [1]
METOLACHLOR	R														
ng/L	T														
PROMETONE	R													50	
ng/L	T													ng/L	
PROMETRYNE	R													50	1000
ng/L	T													ng/L	ng/L [1]
PROPAZINE	R													50	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

TRIAZINES (Cont'd)		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

SPECIAL PESTICIDES (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

MASS SPEC. (Cont'd)		19 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
N-DICHLOROMETHYLENE-PENTACHLOROANALINE	R													0.1	
ug/L	T													ug/L	
DIPHENYL ETHER	R													0.1	
ug/L	T													ug/L	
FLUORANTHENE	R													0.1	
ug/L	T													ug/L	
HEXACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
METHYL PHENANTHRENE	R													0.1	
ug/L	T													ug/L	
NAPHTHALENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROBUTADIENE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPANE	R													0.1	
ug/L	T													ug/L	
PENTACHLOROPROPENE	R													0.1	
ug/L	T													ug/L	
PYRENE	R													0.1	
ug/L	T													ug/L	

WTOS

PLANT BURLINGTON **WATER QUALITY - 1-YEAR SUMMARY (** 1984 **)**

MASS SPEC. (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		19 84													
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	9	47	31	28	12	3	3	4	26	10	26	58		
TOTAL COLIFORM BKGD count/mL	R	22	739	233	202	36	57	71	1420	2275	725	1180	251		
FECAL COLIFORM MF count/100mL	R	<2	9	2	<2	<2	<2	<2	<2	2	<2	3	4	0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R													0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	A	A	A	A	A	P	A	A	A	A	A	A		
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0	0	0	OWDO Bactl

WPOS

PLANT BURLINGTON WATER QUALITY - 1-YEAR SUMMARY (1984)

BACTERIA (Cont'd)		1 9 84												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0	0	0	ODWO Bact I
STANDARD PLATE COUNT MF count/100mL	T														
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A.	T						A								
FECAL COLIFORM P/A	T						A								
E. COLI P/A	T						A								
AROMONAS P/A	T						A								
STAPH. AUREUS P/A	T						A								

TABLE 5.3

WATER QUALITY 3-YEAR SUMMARY 1984-1986

TABLE 5.3

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

GENERAL CHEMISTRY		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
GENERAL CHEMISTRY															
ALKALINITY	R	103.3	93.3	98.3	98.1	98.1	95.8	99.0	95.4	97.2				0.2	
mg/L	T	98.4	89.4	93.1	94.6	88.6	91.6	93.4	90.6	92.0				mg/L	
AMMONIUM TOTAL	R	1.05	<.05	<.05	0.05	<.05	<.05	<0.1	<.05	<.075				0.05	
mg/L	T	<.05	<.05	<.05	<.05	<.05	<.05	<0.1	<.05	<.075				mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	28.3	24.3	26.7	26.9	22.8	24.9	28.6	26.6	27.6				0.2	250
mg/L	T	32.4	25.8	28.2	29.3	24.2	26.1	29.8	28.2	29.0				mg/L	mg/L
COLOUR TCU	R	6.0	<0.5	2.9	4.75	2.0	2.94	8.0	3.0	5.5				0.5	5
	T	1.5	<0.5	0.7	2.0	<0.5	1.0	3.5	1.5	2.5				TCU	TCU
CONDUCTIVITY	R	343	311	333	338	312	326	347	320	334				0.01	
umho/cm	T	359	315	336	347	318	330	354	328	341				UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984-1986)

GENERAL CHEMISTRY (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R	0.17	0.12	0.15	0.16	0.12	0.14	0.15	0.14	0.15				0.01	2.4
mg/L	T	1.06	0.73	0.97	1.06	0.77	0.88	1.04	0.98	1.01				mg/L	mg/L
HARDNESS	R	137.5	125.5	133.6	132.0	125.5	129.2	138.7	132.8	135.8				0.5	
mg/L	T	139.5	127.5	134.1	133.0	126.6	129.9	138.1	133.2	135.7				mg/L	
MAGNESIUM	R	8.85	8.10	8.50	8.48	8.05	8.28	9.00	8.90	8.95				0.05	
mg/L	T	8.95	8.20	8.51	8.45	8.10	8.32	9.10	8.70	8.90				mg/L	c
NITRATE	R	0.40	0.20	0.32	0.55	0.20	0.35	0.50	<.05	0.25				0.05	10 mg/L
mg/L	T	0.45	0.20	0.29	0.45	<.05	0.30	0.40	<.05	0.20				mg/L	as N
NITRITE	R	0.10	<.005	0.02	0.015	<.005	<.005	0.01	0.01	0.01				0.005	1 mg/L
mg/L	T	0.005	<.005	<.005	<.005	<.005	<.005	0.01	<.005	0.008				mg/L	as N
NITROGEN TOTAL KJELDAHL	R	0.40	0.20	0.28	0.35	0.20	0.29	0.60	0.30	0.45				0.1	0.15
mg/L	T	0.40	<.20	0.20	0.40	0.20	0.26	0.40	0.20	0.30				mg/L	mg/L *
PH	R	8.38	7.86	8.23	8.48	7.87	8.18	8.66	8.04	8.35					
	T	8.20	7.59	7.95	8.04	7.57	7.78	7.84	7.64	7.74					
PHOSPHORUS FILTERED REACTIVE	R	0.04	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.015				0.01	
mg/L	T	0.04	<.01	<.01	<.01	<.01	<.01	0.02	<.01	0.01				mg/L	

WPOS

PLANT BURLINGTON **WATER QUALITY - 4-YEAR SUMMARY (** 1984-1986 **)**

GENERAL CHEMISTRY (Cont'd)		19_86			19_85			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
PHOSPHORUS TOTAL	R	0.04	<.02	0.02	0.06	<.01	0.02	0.08	0.06	0.07				0.01	
mg/L	T	0.02	0.01	0.02	0.05	<.01	0.02	0.05	0.01	0.03				mg/L	
SODIUM	R	14.7	12.3	13.8	13.9	11.6	12.9	15.5	13.6	14.6				0.1	
mg/L	T	14.9	12.4	13.8	14.2	12.0	12.9	16.0	13.5	14.8				mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	4.60	1.07	2.02	6.6	0.57	1.83	31.0	1.72	16.36				0.01	1
FTU	T	0.78	0.12	0.39	0.35	0.05	0.21	1.26	0.35	0.81				FTU	FTU
METALS															
ALUMINUM	R													0.003	
mg/L	T													mg/L	
ARSENIC	R													0.001	0.05
mg/L	T													mg/L	mg/L
BARIUM	R													0.001	1
mg/L	T													mg/L	mg/L
BERYLLIUM	R													0.001	
mg/L	T													mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R													0.0003	0.005
mg/L	T													mg/L	mg/L

MOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984-1986)

METALS (Cont'd)			19 86			1985			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
			MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
CHROMIUM		R													0.001	0.05
	mg/L	T													mg/L	mg/L
COBALT		R													0.001	
	mg/L	T													mg/L	
COPPER		R													0.001	1
	mg/L	T													mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R	0.16	0.013	0.053	0.31	0.01	0.061	1.45	0.06	0.76				0.002	0.3
	mg/L	T	0.044	0.012	0.027	0.06	<.005	0.019	0.03	<.01	0.02				mg/L	mg/L c
LEAD	mg/L	R													0.003	0.05
		T													mg/L	mg/L
MANGANESE		R													0.001	0.05
	mg/L	T													mg/L	mg/L
MOLYBDENUM		R													0.001	
	mg/L	T													mg/L	
MERCURY		R													0.01	1
	ug/L	T													ug/L	ug/L
NICKEL		R													0.002	
	mg/L	T													mg/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984- 1986)

METALS (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R													0.001	
mg/L	T													mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R													0.001	
mg/L	T													mg/L	
ZINC	R													0.001	5
mg/L	T													mg/L	mg/L h
PURGEABLES															
BENZENE	R				0	0	0							1	10
ug/L	T				0	0	0							ug/L	ug/L h
BROMOFORM	R				0	0	0							1	350
ug/L	T				2	2	2							ug/L	ug/L ++
CARBON TETRACHLORIDE	R				0	0	0							1	3
ug/L	T				0	0	0							ug/L	ug/L h
CHLOROBENZENE	R				0	0	0							1	100-300
ug/L	T				0	0	0							ng/L	ng/L h*

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

PURGEABLES (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
CHLORODIBROMOMETHANE	R	1.0	0	0.21	0	0	0	0	0	0				1	350
ug/L	T	8.0	5.0	6.4	7.0	0	4.7	3	0	2				ug/L	ug/L ++
CHLOROFORM	R	6.0	0	0.7	0	0	0	0	0	0				1	350
ug/L	T	32.0	14.0	18.6	24.0	1.0	13.5	8	0	5				ug/L	ug/L ++
1,2-DICHLOROBENZENE	R				0	0	0							1	400
ug/L	T				0	0	0							ug/L	ug/L e
1,3-DICHLOROBENZENE	R				0	0	0							1	400
ug/L	T				0	0	0							ug/L	ug/L e
1,4-DICHLOROBENZENE	R				0	0	0							1	400
ug/L	T				0	0	0							ug/L	ug/L e
DICHLOROBROMOMETHANE	R	1.8	0	0.34	0	0	0	0	0	0				1	350
ug/L	T	20.3	8.0	13.5	18.0	1.0	9.9	6	2	4.3				ug/L	ug/L ++
1,1-DICHLOROETHANE	R				0	0	0							1	
ug/L	T				0	0	0							ug/L	
1,2-DICHLOROETHANE	R				0	0	0							1	10
ug/L	T				0	0	0							ug/L	ug/L h
1,1-DICHLOROETHYLENE	R				0	0	0							1	.3
ug/L	T				0	0	0							ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R				0	0	0							1	
ug/L	T				0	0	0							ug/L	

MPOS

PLANT BURLINGTON WATER QUALITY – 4-YEAR SUMMARY (1984 - 1986)

PURGEABLES (Cont'd)		19 86			19 85			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
DICHLOROMETHANE	R				0	0	0							5	40
ug/L	T				0	0	0							ug/L	ug/L c
1,2 DICHLOROPROPANE	R				0	0	0							1	
ug/L	T				0	0	0							ug/L	
ETHYLBENZENE	R				0	0	0							1	1400
ug/L	T				0	0	0							ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R				0	0	0							1	620
ug/L	T				0	0	0							ug/L	ug/L c
O-XYLENE	R				0	0	0							1 ug/L	620
ug/L	T				0	0	0								ug/L c
P-XYLENE	R				0	0	0							1	620
ug/L	T				0	0	0							ug/L	ug/L c
TOLUENE	R				0	0	0							1	100
ug/L	T				0	0	0							ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R				0	0	0							1	1.7
ug/L	T				0	0	0							ug/L	ug/L e
TETRACHLOROETHYLENE	R													1	10
ug/L	T													ug/L	ug/L h

WTOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

PURGEABLES (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
1,1,1-TRICHLOROETHANE	R				0	0	0							1	1000
ug/L	T				0	0	0							ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R				0	0	0							1	6
ug/L	T				0	0	0							ug/L	ug/L e
TRICHLOROETHYLENE	R				0	0	0							1	30
ug/L	T				0	0	0							ug/L	ug/L h
TOTAL TRIHALOMETHANES	R	8.3	0	1.3	0	0	0	0	0	0				3	350
ug/L	T	55.0	27.5	38.2	48.0	2.0	26.3	17	12	1.45				ug/L	ug/L ++
TRIFLUOROCHLOROTOLUENE	R				0	0	0							1	
ug/L	T				0	0	0							ug/L	
ORGANOCHLORINES															
ALDRIN	R	<1	<1	<1	<1	<1	<1							1	700
ng/L	T	<1	<1	<1	<1	<1	<1							ng/L	ng/L **
ALPHA BHC	R	3	2	2.7	5	<1	2.5							1	700
ng/L	T	3	2	2.3	6	<1	3.2							ng/L	ng/L c
ALPHA CHLORDANE	R	< 2	< 2	< 2	< 2	< 2	< 2							2	700
ng/L	T	< 2	< 2	< 2	< 2	< 2	< 2							ng/L	ng/L ***
BETA BHC	R	< 1	< 1	< 1	< 1	< 1	< 1							1	300
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L c
DIELDRIN	R	< 2	< 2	< 2	< 2	< 2	< 2							2	700
ng/L	T	< 2	< 2	< 2	< 2	< 2	< 2							ng/L	ng/L **

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

ORGANOCHLORINES (Cont'd)		19 86			19 85			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
ENDRIN	R	< 4	< 4	< 4	< 4	< 4	< 4							4	200
ng/L	T	< 4	< 4	< 4	< 4	< 4	< 4							ng/L	ng/L
GAMMA CHLORDANE	R	< 2	< 2	< 2	< 2	< 2	< 2							2	700
ng/L	T	< 2	< 2	< 2	< 2	< 2	< 2							ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	3000 +++
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L
HEPTACHLOR	R	< 1	< 1	< 1	< 1	< 1	< 1							1	3000
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L +++
HEXACHLOROBENZENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	10
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L h
HEXACHLOROBUTADIENE	R	< 1	< 1	< 1	< 1	< 1	< 1								
ug/L	T	< 1	< 1	< 1	< 1	< 1	< 1								
HEXACHLOROETHANE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	19000
ng/L	T	< 1	< 1	< 1	3	< 1	< 1							ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R	< 5	< 5	< 5	< 5	< 5	< 5							5	100000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L
MIREX	R	< 5	< 5	< 5	< 5	< 5	< 5							5	
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

ORGANOCHLORINES (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
OCTACHLOROSTYRENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	
O,P-DDT	R	< 5	< 5	< 5	< 5	< 5	< 5							5	30000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L d
OXYCHLORDANE	R	< 2	< 2	< 2	< 2	< 2	< 2							2	
ng/L	T	< 2	< 2	< 2	< 2	< 2	< 2							ng/L	
PCB TOTAL	R	<20	<20	<20	<20	<20	<20							20	3000
ng/L	T	<20	<20	<20	<20	<20	<20							ng/L	ng/L t
PENTACHLOROBENZENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	74000
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L e
P,P-DDD	R	< 5	< 5	< 5	< 5	< 5	< 5							5	d
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	
P,P-DDE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	d
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	
P,P-DDT	R	< 5	< 5	< 5	< 5	< 5	< 5							5	d
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	
1,2,3,4-TETRACHLOROBENZENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	
1,2,3,5-TETRACHLOROBENZENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

ORGANOCHLORINES (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
1,2,4,5-TETRACHLOROBENZENE	R	< 1	< 1	< 1	< 1	< 1	< 1							1	38000
ng/L	T	< 1	< 1	< 1	< 1	< 1	< 1							ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	10000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	15000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	10000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	
ng/L	T	< 5	< 5	< 5	5	< 5	< 5							ng/L	
2,4,5-TRICHLOROTOLUENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	10000
ng/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	ng/L g

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

ORGANOCHLORINES (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
2,6,A-TRICHLOROTOLUENE	R	< 5	< 5	< 5	< 5	< 5	< 5							5	
mg/L	T	< 5	< 5	< 5	< 5	< 5	< 5							ng/L	
TRIAZINES															
ALACHLOR	R														
ng/L	T														
AMETRINE	R													50	
ng/L	T													ng/L	
ATRATONE	R														
ng/L	T														
ATRAZINE	R													50	46000
ng/L	T													ng/L	ng/L 1
BLADEX	R													100	10000
ng/L	T													ng/L	ng/L 1
METOLACHLOR	R														
ng/L	T														
PROMETONE	R													50	
ng/L	T													ng/L	
PROMETRYNE	R													50	1000
ng/L	T													ng/L	ng/L 1
PROPAZINE	R													50	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

TRIAZINES (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L I
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L I
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L I
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

SPECIAL PESTICIDES (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

WPOS

PLANT BURLINGTON **WATER QUALITY - 4-YEAR SUMMARY (** 1984 - 1986 **)**

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		19_86			19_85			19_84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L

MPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

MASS SPEC. (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE^1
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
N-DICHLOROMETHYLENE-PENTACHLOROANALINE	R													0.1 ug/L	
ug/L	T														
DIPHENYL ETHER	R													0.1 ug/L	
ug/L	T														
FLUORANTHENE	R													0.1 ug/L	
ug/L	T														
HEXACHLOROPROPENE	R													0.1 ug/L	
ug/L	T														
METHYL PHENANTHRENE	R													0.1 ug/L	
ug/L	T														
NAPHTHALENE	R													0.1 ug/L	
ug/L	T														
PENTACHLOROBUTADIENE	R													0.1 ug/L	
ug/L	T														
PENTACHLOROPROPANE	R													0.1 ug/L	
ug/L	T														
PENTACHLOROPROPENE	R													0.1 ug/L	
ug/L	T														
PYRENE	R													0.1 ug/L	
ug/L	T														

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

MASS SPEC. (Cont'd)		19 86			19 85			19 84			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	332	2	90	943	11	153	58	3	21					
TOTAL COLIFORM BKGD count/100mL	R	855	40	303	>5000	74	1016	2275	22	601					
FECAL COLIFORM MF count/100mL	R	11	1	3	116	< 2	16	9	< 2	2				0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R													0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	P	A	A	A	A	A	P	A	A					
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0	0	0	0	0	0	0	0	0				0	OWDO Bact I

WPOS

PLANT BURLINGTON WATER QUALITY - 4-YEAR SUMMARY (1984 - 1986)

BACTERIA (Cont'd)		1986			1985			1984			19__			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE¹
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
TREATED WATER: (Cont'd)		0	0	0	0	0	0	0	0	0					
FECAL COLIFORM MF count/100mL	T													0	ODWO Bactl
STANDARD PLATE COUNT MF count/100mL	T														
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T														
FECAL COLIFORM P/A	T														
E. COLI P/A	T														
AROMONAS P/A	T														
STAPH. AUREUS P/A	T														

Table A - Footnotes

1 = see individual footnotes for Agency of guideline origin
c = California State Department of Health Action Level
d = OWDO for DDT (contains other isomers such as OPDDT and PPDDT)
e = USEPA ambient guideline
ea = United States Environmental Protection Agency (USEPA) ambient level for endosulfan (contains other isomers)
ep = USEPA proposed maximum contaminant level for drinking water
g = suggested Health and Welfare Canada/Ontario Ministry of the Environment guideline value
h = World Health Organization (WHO) guideline
h* = World Health Organization (WHO) Odour Threshold
mg/L = milligrams per litre, parts per million, (ppm)
ng/L = nanograms per litre, parts per trillion, (ppt)
Presence/Absence = microbiological test to indicate presence or absence of coliform bacteria
R = raw water
T = Treated Drinking Water
t = ODWO interim maximum acceptable concentration, (IMAC)
ug/L = micrograms per litre, parts per billion, (ppb)
y = New York State (Taste and Odour) proposed drinking water guideline
++ = total Trihalomethanes
+++ = combined total: Heptachlor and Heptachlor Epoxide
* = if other than DWSP Detection Limit
** = total of Aldrin and Dieldrin
*** = Chlordane is a mixture of alpha and gamma isomers
! = Ministry of the Environment and Health and Welfare Canada, (IMAC)

TABLE 6.0

BACTERIOLIGICAL TESTING 1984, 1985, 1986

TABLE 6.0: BACTERIOLOGICAL TESTING (1984)

MOE WPOS PROTOCOL   BURLINGTON WATER PURIFICATION PLANT

		TOTAL COLI				FECAL COLI				FECAL STREP			
		A	B	C	D	A	E	F	G	A	H	I	J
JAN	R		5				5				5		
	T	5				5				5			
FEB	R		3	1			3	1			1	2	1
	T	4				4				4			
MAR	R		4				4				3	1	
	T	4				4				4			
APR	R		4				4				4		
	T	4				4				4			
MAY	R		5				5				4	1	
	T	5				5				5			
JUN	R		4				4				3	1	
	T	4				4				4			
JUL	R		5				5				4	1	
	T	5				5				5			
AUG	R		4					1	3		4		
	T	4				4				4			
SEP	R			3	1		4				4		
	T	4				4				4			
OCT	R		5				5				4	1	
	T	5				5				5			
NOV	R		3				3				3		
	T	3				3				3			
DEC	R		2				2					2	
	T	2				2				2			

NOTE: All results are for 100 mL samples; tests carried out at MOE lab, Resources Road.

A = Absent
B = 1-100
C = 101-5000
D = >5000

E = 0-10
F = 11-500
G = >500

H = 0-1
I = 2-50
J = >50

TABLE 6.0: BACTERIOLOGICAL TESTING (1985)

MOE WPOS PROTOCOL BURLINGTON WATER PURIFICATION PLANT

		TOTAL COLI				FECAL COLI				FECAL STREP			
		A	B	C	D	A	E	F	G	A	H	I	J
JAN	R		3	2			3	2			3	2	
	T	5				5				5			
FEB	R		4				4				3	1	
	T	4				4				4			
MAR	R		4				4				4		
	T	4				4				4			
APR	R		3	1			4				4		
	T	4				4				4			
MAY	R		5				5				5		
	T	5				5				5			
JUN	R		3				3				2	1	
	T	3				3				3			
JUL	R		3	1			2	2			2	2	
	T	4				4				4			
AUG	R		3				2	1			3		
	T	3				3				3			
SEP	R		4				3	1			3	1	
	T	4				4				4			
OCT	R		4				4				4		
	T	4				4				4			
NOV	R		2	2			1	3			2		2
	T	4				4				4			
DEC	R		5				5				5		
	T	5				5				5			

NOTE: All results are for 100 mL samples; tests carried out at MOE lab, Resources Road.

A = Absent
B = 1-100
C = 101-5000
E = 0-10
F = 11-500
G = >500
H = 0-1
I = 2-50
J = >50

TABLE 6.0: BACTERIOLOGICAL TESTING (1986)

MOE WPOS PROTOCOL

BURLINGTON WATER PURIFICATION PLANT

		TOTAL COLI				FECAL COLI				FECAL STREP			
		A	B	C	D	A	E	F	G	A	H	I	J
JAN	R		2	1			3				2	1	
	T	3				3				3			
FEB	R		4				3	1			3	1	
	T	4				4				4			
MAR	R		3	1			4				3	1	
	T	4				4				4			
APR	R		4				4				4		
	T	4				4				4			
MAY	R		3				3				2	1	
	T	3				3				3			
JUN	R		4				4						
	T	4				4							
JUL	R		2	2			2	2					
	T	4				4							
AUG	R		4				4						
	T	4				4							
SEP	R		4				4						
	T	4				4							
OCT	R		4				4						
	T	4				4							
NOV	R		4				4						
	T	4				4							
DEC	R												
	T												

NOTE: All results are for 100 mL samples; tests carried out at MOE lab, Resources Road.

A = Absent
B = 1-100
C = 101-5000
D = >5000

E = 0-10
F = 11-500
G = >500

H = 0-1
I = 2-50
J = >50

SAMPLE DAILY LOG SHEETS

SAMPLE WATER COMPLAINT SHEETS

The Regional Municipality Of Halton

City Of ____________

WATER PURIFICATION PLANT

(Daily Record)

Month ________ 19____

Date	RAW WATER					TREATED WATER												CHEMICAL USED						
	Turbidity J.T.U.	Temp. °C	Pumped M.I.G.D.			Turbidity J.T.U.	pH	Smell	Taste	Chlorine Residue mg/l	Pumped M.I.G.D.			Fluoride Residue mg/l	Washwater Used M.I.G.			Chlorine Used lbs.		Sodium Chlorite Used lbs.	Fluoride Used (gals.)	Polymer Used (gals.)	~~Sodium Silicofluoride Used lbs.~~	Mixing Water (gals.)
			4 - 12	12 - 8	8 - 4						4 - 12	12 - 8	8 - 4		4 - 12	12 - 8	8 - 4	Pre	Post					
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18																								
19																								
20																								
21																								
22																								
23																								
24																								
25																								
26																								
27																								
28																								
29																								
30																								
31																								
Total																								

POWER USED IN MONTH ____________ kwh

BURLINGTON WATER TREATMENT PLANT
CURRENT STATUS REPORT

OPERATOR ____________
I2-8

DATE ____________

	AVG.	HIGH	LOW
FINISHED WATER CHLORINE RESIDUAL (mg/l)			
FINISHED WATER TURBIDITY (NTU)			
RAW WATER TURBIDITY (NTU)			
FLUORIDE RESIDUAL (mg/l)			
FINISHED WATER pH			
NITROGEN, AS AMMONIA (mg/l)			
FINISHED WATER TEMPERATURE(°C)			
RAW WATER TEMPERATURE (°C)			

FINISHED WATER PRODUCTION ____________ M^3

BACKWASH WATER ____________ M^3

8-4 Operator--------

4-12Operator--------

Sick------------------

Vacation------------

M.O.E.-------------

S D O -------------

Other--------------

CHEMICAL USAGE:

CHLORINE		Kg
SODIUM CHLORITE		Kg
ALUMINUM SULFATE		Kg
FLUORIDE		Kg
POLYMER		Kg
POLY ALUMINUM CHLORIDE		Kg
POWDERED ACTIVATED CARBON		Kg

PLANT EQUIPMENT BREAKDOWN, OR COMMENTS:

BURLINGTON W.T.P.

DATE APP-172

	Alum.						Poly.					[redacted]							[redacted]							Temp. C			
Total Brt. Fwd.																													
Name & Time	Speed	Stroke	Pulley	Wt. Kg.	Ds. Mg/l	Rs. Mg/l	Speed	Stroke	Pulley	Wt. Kg.	Ds.Mg/l	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	R.W.	F.W.	Taste	Odour
12-8																													
8-4																													
4-12																													
High																													
Low																													
Aver. res.																										Hydro cons. Kw/h.			
Aver. dose																													
Daily Tot.																													
Acc. Daily Tot																													
A Month Tot.																													

	Pre-Chlorine						Post-Chlorine						Amm.		Turb.		pH				
Total Brt. Fwd.																					
Name & Time	Wt. Kg.	Rota	Kg. used	Ds. Mg/l	Rs. Mg/l	An. Mg/l	Wt. Kg.	Rota	Kg. used	Ds. Mg/l	Rs. Mg/l	An. Mg/l	R.W.	F.W.	R.W.	F.W.	R.W.	F.W.	Raw Water M3.	Backwash Water M3.	Finished Water M3.
12-8																					
8-4																					
4-12																					
High																					
Low																					
Avg. res.																					
Avg. ds.											Wind										
Daily Tot.											Precip.										
Acc. Daily Tot											Runoff										
Acc. Month Tot											Air Temp.										

Halton

WATER COMPLAINTS

Name ______________________ Date ____ ____ ____ Time ________ ☐ A ☐ P
yr. mo. day

Address ______________________

Postal Code ______________________ Phone ______________________

Location of complaint as above ☐. or:

____

____

Nature of Complaint

Taste and Odour

The water was:

- ☐ Hot ☐ Cold
- ☐ Medicinal
- ☐ Chlorinated
- ☐ Oily ☐ Septic
- ☐ Sour ☐ Bitter
- ☐ Musty, fishy, grassy
- ☐ Dry after taste
- ☐ Burning
- ☐ Cloudy, white
- ☐ Dirty rusty
- ☐ Nauseous
- ☐ Other

Water

- ☐ Low Pressure
- ☐ High Pressure
- ☐ No Pressure
- ☐ No Water

Details of Complaint ______________________

____

____

____

____

____

____

____

Action taken by Region

☐ Visit ☐ Collect samples

☐ Sent samples: Who ______________________ Date ____ ____ ____ CEO No. ________
yr. mo. day

☐ Notified (who) ______________________

☐ Other (specify) ______________________

Call taken by: ________ ______________________

white - plant blue - water plant engineer yellow - lab

84-02

PLANT INSPECTION SUMMARY

MUNICIPALITY - BURLINGTON W.T.P.
PROJECT No. - 7-2017

Inspected by: GRANT YARROW }
ANN VATDIC }
JANUSZ BUDZIAKOWSKI) MOE D. KING - OPERATOR
RON HUNSINGER)
G. SIGAI)

Date: NOVEMBER 14, 1986

ORIGINAL CONSULTANT - SCHWINDT (1935)
EXPANSION (1983)

SIMCOE PRESENTLY DOING THE PROCESS CONTROL SYSTEM

W.P.O.S. - PLANT INSPECTION

1. Plant Design Rate:
Plant Rated Capacity:
Plant Records: RECORDS AVAILABLE

2. Raw Water Source: LAKE ONTARIO
Water Quality Records: DWSP FORM COMPLETED
RECORDS AVAILABLE

3. Intake: Type: 2 - INTAKES CONCRETE PRESSURE PIPE
Location:
Diameter:
Length: NEW 2500 FT - 60"φ
OLD SHORTER - 30"φ

Crib: Type: RECTANGULAR WOOD/STEEL
Size: BACK FLUSH AVAILABLE - BUT FRAZIL ICE NOT A PROBLEM

Screens: Type: 2 - ONE FIXED
Size: - ONE MECHANICAL

4. Wet Well:
Size: 2 WELLS – NEW / OLD
Location:
Type: PRECHLORINATION MIXED BY TURBULENCE — 1 mg/l

5. Low Lift Pumps:
Number:
Type:
Capacity:
Flow Metering:

6. Chemical Feed System:
Type:
Feeder: WET FOR CATFLOCT
Location:
Feed Points:

- AUTOMATIC BASED ON FLOW (CHANGES SPEED OF FEEDER)
- CHLORINE INJECTED IN TWO POINTS IN RAW WATER WELL
- REMOTE PANEL CONTROLS STROKE OF FEED PUMP — GIVES READOUT FOR COMPUTER TO DO DOSAGE CALCULATION

Type of Chemicals:

- CHLORINE DIOXIDE USED TO BE USED BUT NOW ABANDONED — CAUSED METALLIC TASTE (DANGEROUS)
- ALUM + POLYMER (WILL BE TRYING POLY ALUMINUM CHLORIDE – PAC) 2 mg/l ALUM & 0.25 mg/l POLYMER (CALGON CATFLOCT)
- FLUORIDE — HYDROFLUOSILICIC ACID.

Hazards: FLUORIDE IN SEPARATE ROOM (BERMED – WILL NOT CONTAIN WHOLE TANK)

Problems: ALUM TANKS ALSO BERMED – BUT WILL NOT CONTAIN CONTENTS

7. Chemical Mixing: POLYMER + ALUM ADDED HERE
(a) Flash Mixer:
Type: IN LINE FLASH MIXER
Ret. Time:
"G" Value:

(b) Flocculator:
Type: SPIRAL FLOW (OVER/UNDER)
Ret. Time: WORK WELL AT 12-15 MGD
"G" Value:

3 UNITS ON NEW PLANT –

NONE ON OLD –

NOTE ALUM NOT EFFECTIVE BY ITSELF — NEEDS POLYMER (10:1 RATIO)

8. Settling: Type: FLOC CARRYOVER TO FILTERS
Capacity:
Desludging:
Wastes To:

9. Filtration: Type: CONTINUOUS
Number: 18 — 1-7 (OLD PLANT) - NOT WORKING; 8-18 WORKING
Capacity:
Fil. Rate
Media: SAND/ANTHRACITE - BUT CONSIDERABLE INTERMIXING
Underdrain: - NO FILTER TO WASTE
B.W. Rate: - NO INDIVIDUAL TURB. MONITORING
* B.W. Frequency:
Turb. Monitoring:
Wastes To: HOLDING TANK - SLUDGE TO SEWER, OVERFLOW TO LAKE (LAST PART OF B.W. ACTUATED BY TURBIDIMETER)

2-ADDITIONAL FILTERS NOT INSTALLED WOULD IMPROVE OPERATION (NOT NECESSARILY QUALITY)

10. Water Storage:

(a) Clearwell: Type: CL$_2$ (POST) + FLUORIDE INTO HEADER TO HIGH PUMPS
Capacity:
Size: NO CONTACT TIME
(b) Reservoir: 7 ON SYSTEM ≈ 16 HOURS STORAGE
(c) Standpipe or Water Tower:

11. High Lift Pumps: TIED TO OAKVILLE PLANT
Number: 36 MGD CAPACITY - 5 pumps
Type:
Capacity:
Flow Metering: STANDBY DIESEL ≈ 20 MGD
ANOTHER DIESEL RUNS L.L. PUMPS, B.W. PUMPS, LIGHTS ETC..

* BACKWASH OBSERVED - NO VISIBLE CHANGE IN TURBIDITY THROUGHOUT; CONSIDERABLE AMOUNT OF RESIDUE LEFT ON ANTHRACITE.

12. Laboratory Facilities: - GOOD LAB. FACILITIES (FUME HOOD)

(a) Equipment: ALL SAMPLE LINES COME BACK TO LAB
GS. BEING INSTALLED FOR DINSP
~~HACH~~ TURB, HACH FIELD KIT

LACK OF EQUIPMENT.

(b) Routine: Tests: VERY LITTLE JAR TESTING DONE
(TURB DOES NOT CHANGE)
- pH, TURB, FLUORIDE RES. (TWICE
TEMP, ALUM RES A SHIFT)
(DAILY) AMMONIA CL2 RES
ON LINE TURB. MONITORING

13. Maintenance Pgms:

REGULAR FOR INSTRUMENTATION

INCENTIVE PROGRAM FOR SUGGESTIONS

14. Plant Schematic: AVAILABLE

Plant Drawings: AVAILABLE

15. General Comments:

- STREAMING CURRENT METER HAS BEEN TEST
  - WORKS WELL PROBABLY SAVES ON CHEMICALS
- PROCESS FLOW SHEET (FROM REGION)
- TIED INTO OAKVILLE PLANT (BY COMPUTER)
- INFREQUENT OCCURRENCE OF PHENOLS
- TASTE/ODOUR DUE TO ALGAE
- COMPUTERIZED CONTROL
- GOOD SECURITY
- MANY SIGNS FOR HAZARDS
- MERCURY SWITCHES USED FOR OVERFLOW CONTROL
- CLEAN PLANT.

ADDITIONAL COMMENTS:

- MIXING EFFICIENCY OF COAGULANT ADDITION SHOULD BE REVIEWED
- OILY SCUM ON FILTERS.
- Cl_2 DEMAND INCREASES WITH PAC.
- PAC IS NOT DILUTED -- FE BEFORE LOWLIFTS
- SHOULD INCLUDE PAC DEMONSTRATION.

PHOTOGRAPHIC RECORD OF PLANT FACILITIES

BURLINGTON WATER PURIFICATION PLANT

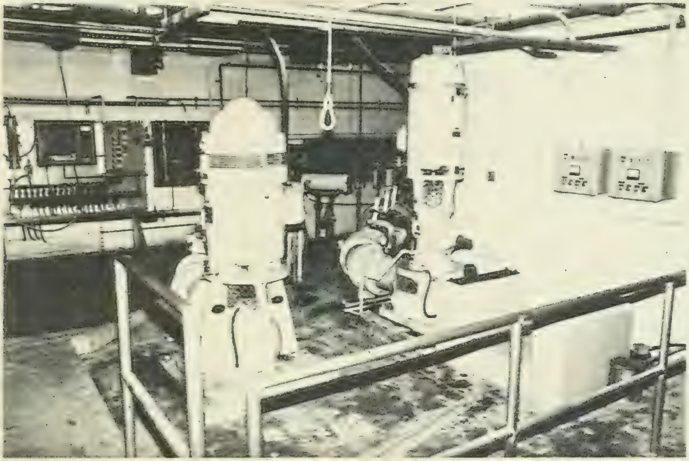
OPTIMIZATION STUDY

PROJECT NO. 7-2017

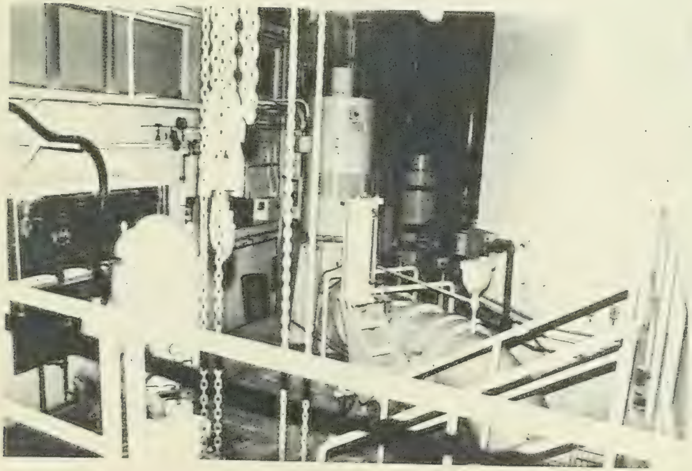
PHOTOGRAPHIC RECORD OF PLANT FACILITIES

TABLE OF CONTENTS

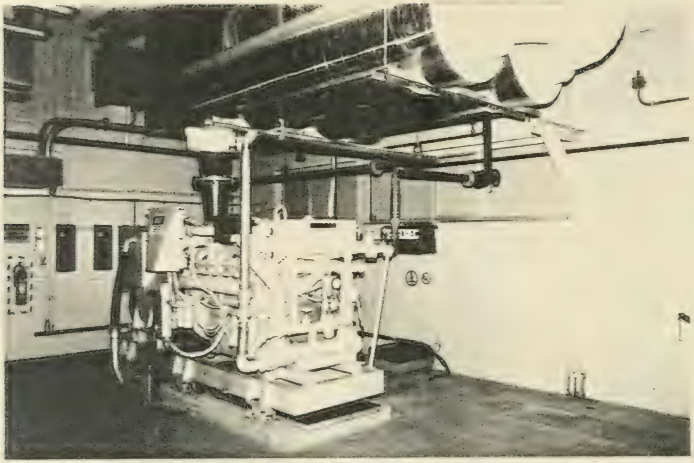
Plate No.		Page
1	Low Lift Pumping Units 1 and 2	1
2	Low Lift Pumping Units 3, 4, 5, and 6	1
3	Low Lift Diesel Generator Set	2
4	Travelling Screen	2
5	Chlorine Storage and Travelling Crane	3
6	Chlorinators and Analyzer	3
7	Alum Storage	4
8	Alum Feed Pumps	4
9	Polymer Storage and Polymer Feed Pumps	5
10	Flocculation Tanks	5
11	Dual Media Filters	6
12	Filter Remote Terminal Unit	6
13	Backwash Pump	7
14	Washwater Pump	7
15	Fluoride Feed Pumps	8
16	High Lift Pumping Units	8
17	High Lift Diesel Generator Set	9
18	Central Control Console	9



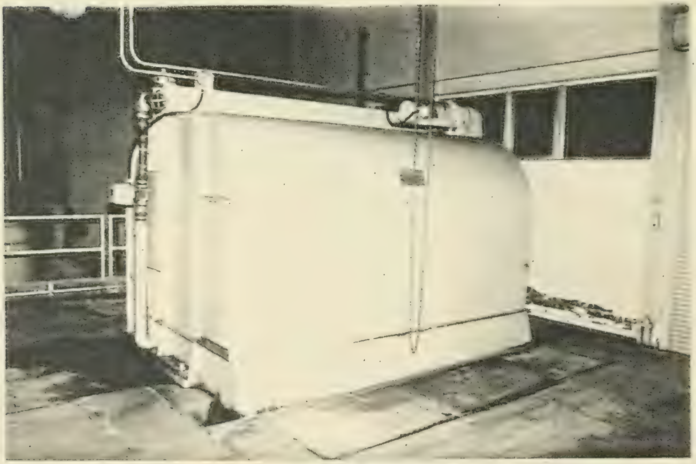
1



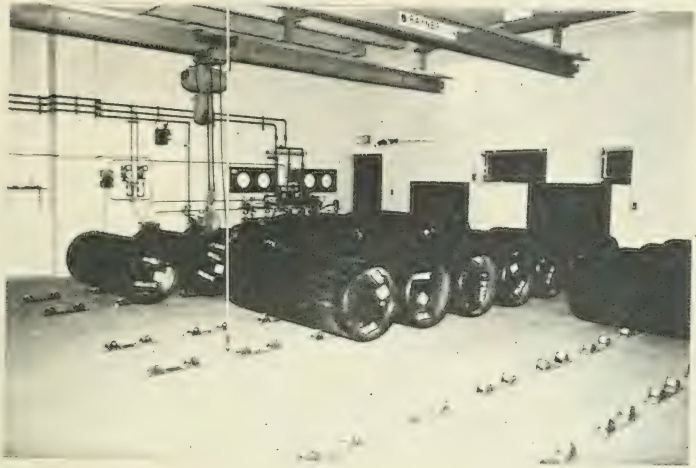
2



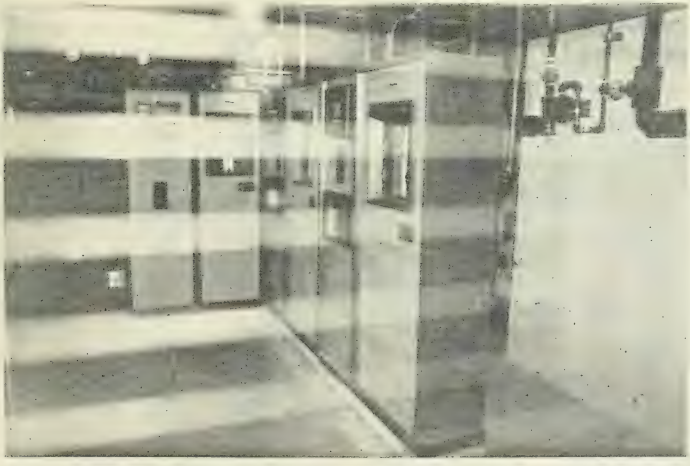
3



4



5

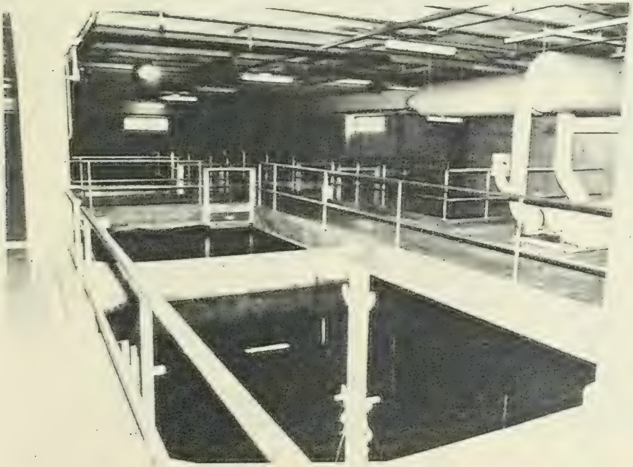


6

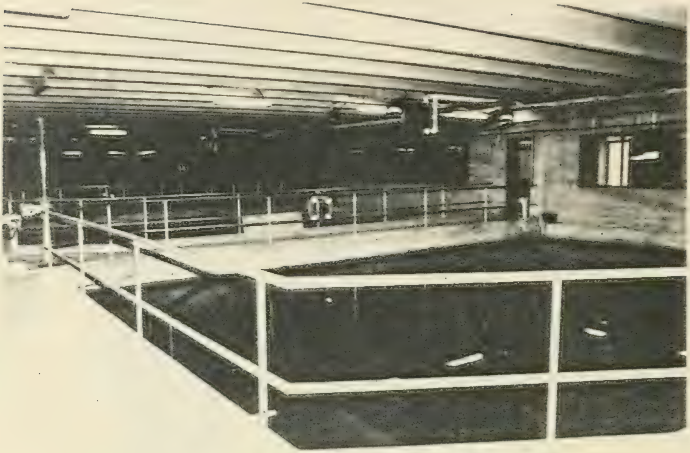
7

8

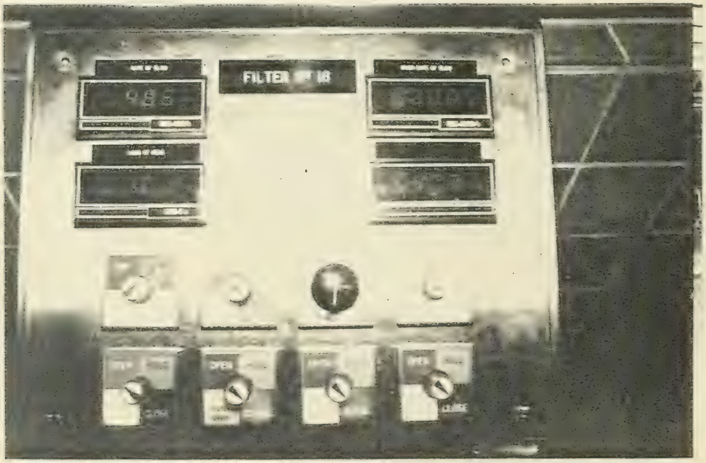
9



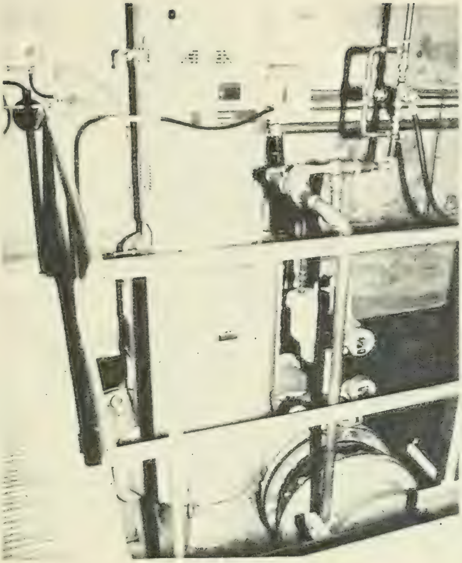
10

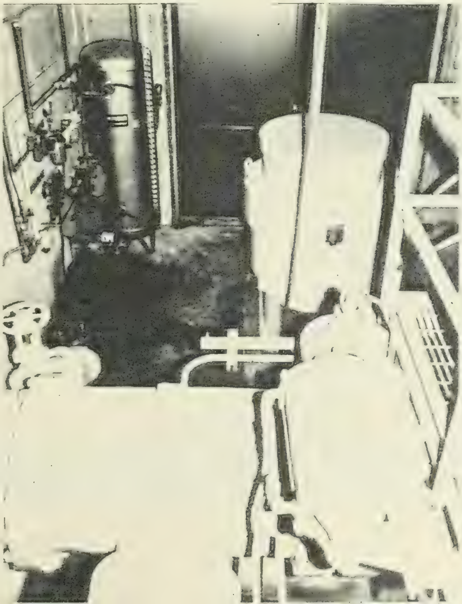


11

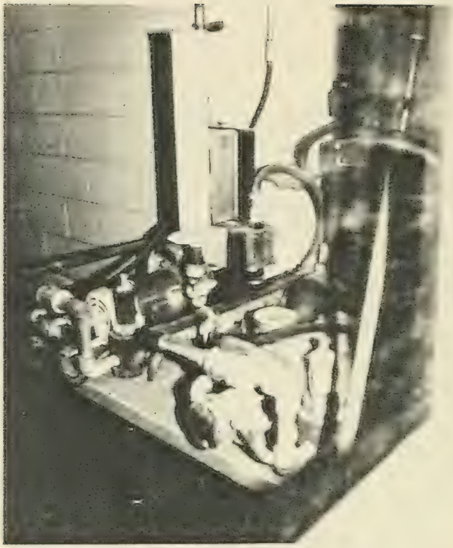


12

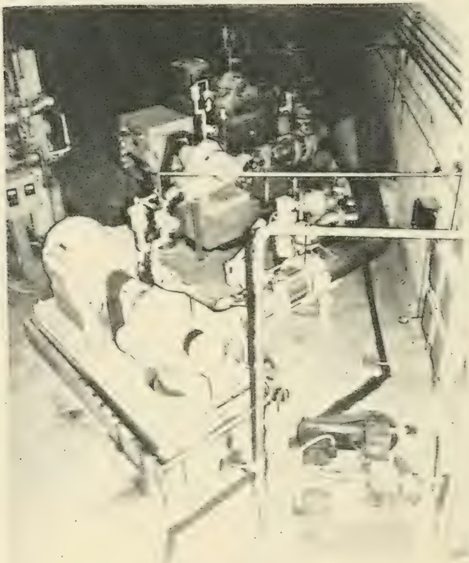




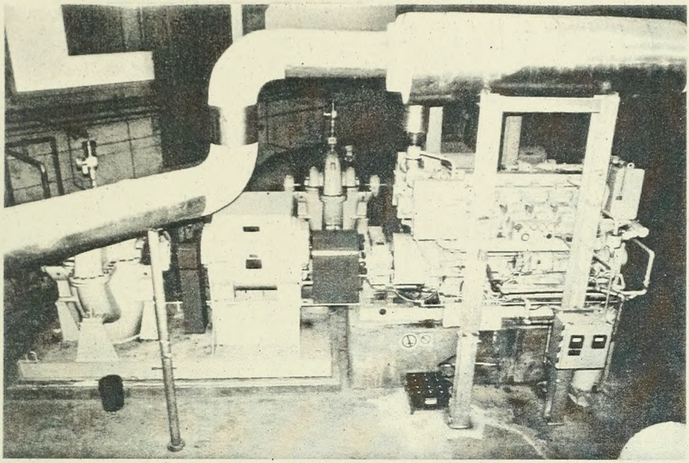
14



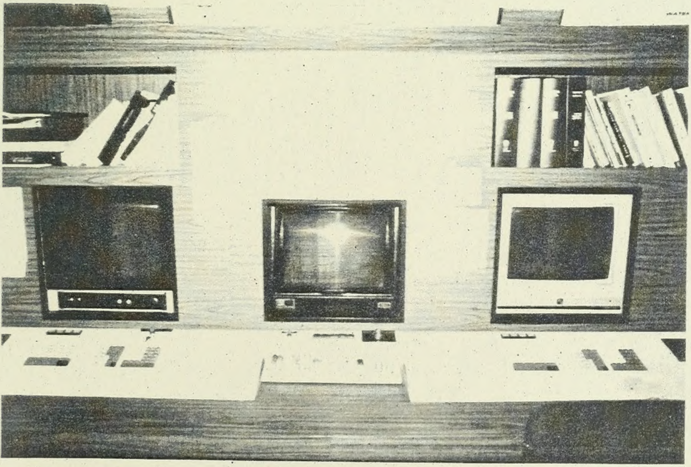
15



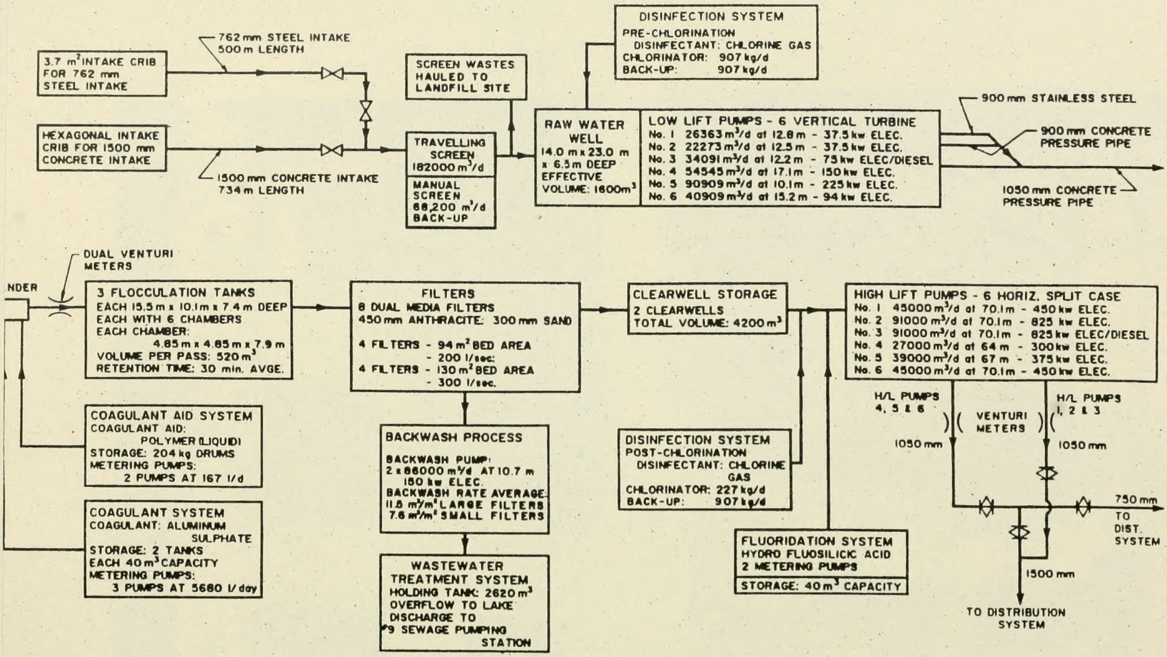
16



17



18


3.7 m² INTAKE CRIB FOR 762 mm STEEL INTAKE
762 mm STEEL INTAKE 500 m LENGTH
HEXAGONAL INTAKE CRIB FOR 1500 mm CONCRETE INTAKE
1500 mm CONCRETE INTAKE 734 m LENGTH
SCREEN WASTES HAULED TO LANDFILL SITE
TRAVELLING SCREEN 182000 m³/d
MANUAL SCREEN 68,200 m³/d BACK-UP
DISINFECTION SYSTEM
PRE-CHLORINATION
DISINFECTANT: CHLORINE GAS
CHLORINATOR: 907 kg/d
BACK-UP: 907 kg/d
RAW WATER WELL
14.0 m x 23.0 m x 6.3 m DEEP
EFFECTIVE VOLUME: 1600 m³
LOW LIFT PUMPS - 6 VERTICAL TURBINE
No. 1 26363 m³/d at 12.8 m - 37.5 kw ELEC.
No. 2 22273 m³/d at 12.5 m - 37.5 kw ELEC.
No. 3 34091 m³/d at 12.2 m - 75 kw ELEC/DIESEL
No. 4 54545 m³/d at 17.1 m - 150 kw ELEC.
No. 5 90909 m³/d at 10.1 m - 225 kw ELEC.
No. 6 40909 m³/d at 15.2 m - 94 kw ELEC.
900 mm STAINLESS STEEL
900 mm CONCRETE PRESSURE PIPE
1050 mm CONCRETE PRESSURE PIPE
NDER
DUAL VENTURI METERS
3 FLOCCULATION TANKS
EACH 15.5 m x 10.1 m x 7.4 m DEEP
EACH WITH 6 CHAMBERS
EACH CHAMBER: 4.85 m x 4.85 m x 7.9 m
VOLUME PER PASS: 520 m³
RETENTION TIME: 30 min. AVGE.
FILTERS
8 DUAL MEDIA FILTERS
450 mm ANTHRACITE: 300 mm SAND
4 FILTERS - 94 m² BED AREA - 200 l/sec.
4 FILTERS - 130 m² BED AREA - 300 l/sec.
CLEARWELL STORAGE
2 CLEARWELLS
TOTAL VOLUME: 4200 m³
HIGH LIFT PUMPS - 6 HORIZ. SPLIT CASE
No. 1 45000 m³/d at 70.1 m - 450 kw ELEC.
No. 2 91000 m³/d at 70.1 m - 825 kw ELEC.
No. 3 91000 m³/d at 70.1 m - 825 kw ELEC/DIESEL
No. 4 27000 m³/d at 64 m - 300 kw ELEC.
No. 5 39000 m³/d at 67 m - 375 kw ELEC.
No. 6 45000 m³/d at 70.1 m - 450 kw ELEC.
COAGULANT AID SYSTEM
COAGULANT AID: POLYMER (LIQUID)
STORAGE: 204 kg DRUMS
METERING PUMPS: 2 PUMPS AT 167 l/d
COAGULANT SYSTEM
COAGULANT: ALUMINUM SULPHATE
STORAGE: 2 TANKS EACH 40 m³ CAPACITY
METERING PUMPS: 3 PUMPS AT 5680 l/day
BACKWASH PROCESS
BACKWASH PUMP: 2 x 86000 m³/d AT 10.7 m 180 kw ELEC.
BACKWASH RATE AVERAGE: 11.8 m³/m² LARGE FILTERS 7.6 m³/m² SMALL FILTERS
WASTEWATER TREATMENT SYSTEM
HOLDING TANK: 2620 m³
OVERFLOW TO LAKE
DISCHARGE TO #9 SEWAGE PUMPING STATION
DISINFECTION SYSTEM
POST-CHLORINATION
DISINFECTANT: CHLORINE GAS
CHLORINATOR: 227 kg/d
BACK-UP: 907 kg/d
FLUORIDATION SYSTEM
HYDRO FLUOSILICIC ACID
2 METERING PUMPS
STORAGE: 40 m³ CAPACITY
H/L PUMPS 4, 5 & 6
VENTURI METERS
H/L PUMPS 1, 2 & 3
1050 mm
1050 mm
750 mm
TO DIST. SYSTEM
1500 mm
TO DISTRIBUTION SYSTEM

BURLINGTON WATER PURIFICATION PLANT
OPTIMIZATION STUDY
M.O.E. PROJECT No. 7 - 2017
DWG. No. 4

FILE No 100 54-A4-403